FOR Tomorrow's Planning..

Photronic Cells now being made for war purposes only, hold many new possibilities for design engineers searching for better methods or new products for post-war markets.

The improved Type 3 photo-cell has a marked increase in sensitivity and can be produced in various outputs and various linearity factors, to meet specific circuit requirements. They can be matched in spectral sensitivity, too; to give practically the same spectral response curve throughout the color spectrum. And since the fatigue factor has been materially reduced, their response is more uniform, and far more rapid.

The development of the Type 3 is the result of continued research and experience in the processing of photo-cells dating back to 1930 . . . the year in which WESTON introduced the first American-made commercial cell of the barrier-layer type.

Type 3 Photronic Cells can be supplied in various styles and cases, as well as unmounted in a variety of shapes and sizes. Complete technical data, in booklet form, available to design engineers on request. Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark, New Jersey.

*PHOTRONIC—*A registered trademark designating the photoelectric cells and photo-electric devices manufactured exclusively by the Weston Electrical Instrument Corp.*

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

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Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

September 18, 1943 — Vol. 120, No. 12

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330 West 42nd Street, New York 18, N. Y.
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Please change my address on Electrical World

From .....

.....

To .....

.....

Signed .....

let's break it down...

We've only been knocking at that door . . . Midway . . . Guadalcanal, Attu, Buna, Munda . . . Tunisia, Pantelleria, Sicily. . . .

Magnificent actions all . . . but only steps that have brought us to the threshold of Victory.

Now it's here. *Invasion!*

But we've got to back these fighters with a fighting home front.

The 3rd War Loan Drive is on. The quota is $15,000,000,000.

The United States Government is asking you to invest in at least an *extra* $100 bond during September. But the job doesn't end there. We've got to get our family, friends and fellow employees to invest in their share of these victory-producing bonds and back the attack that has brought us this far.

Remember, this is what we've been waiting for. This is *invasion!*

back the attack with war bonds!

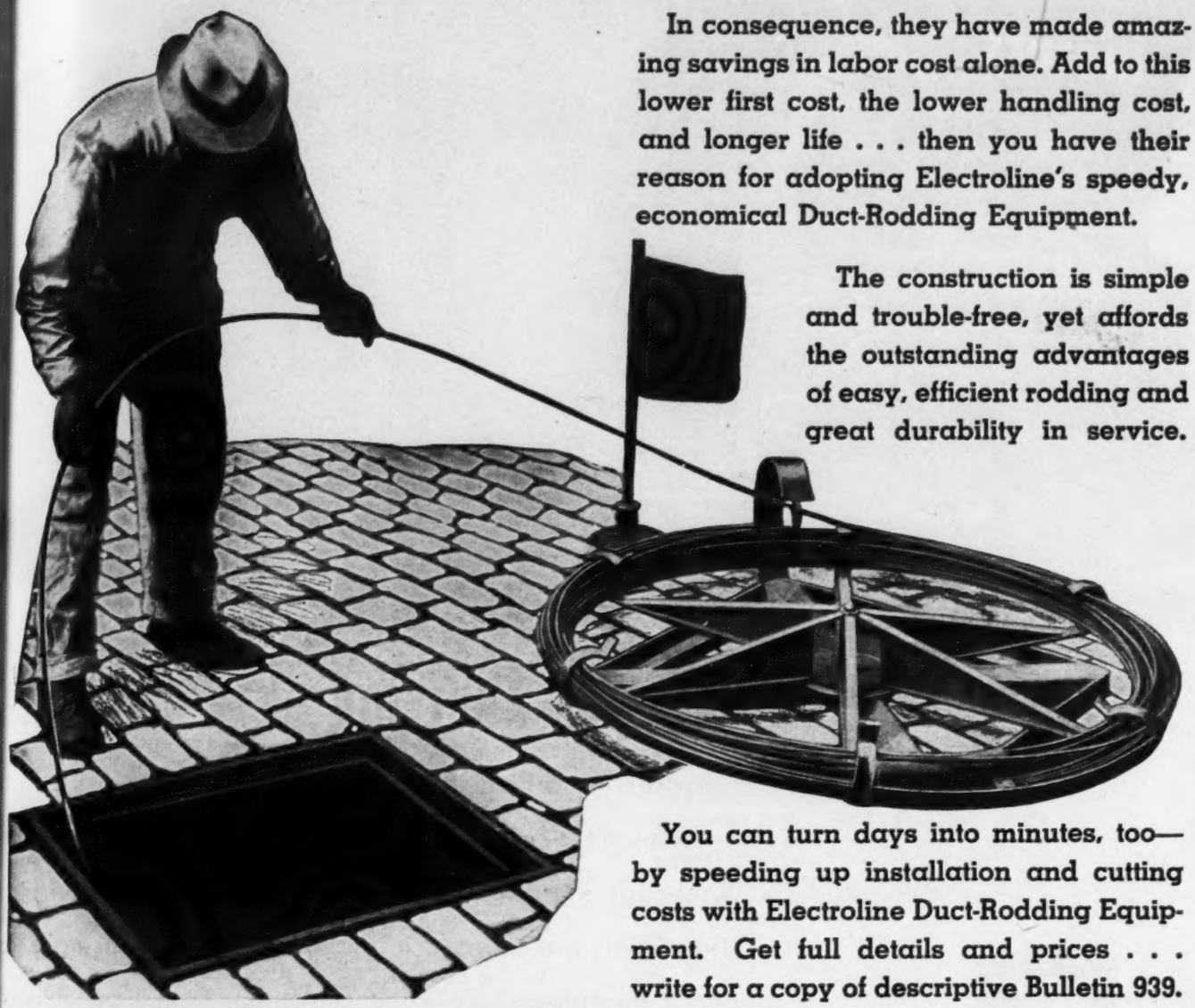
The Okonite Company, Passaic, N.J.

manufacturers of insulated wires and cables since 1878

UTILITIES have found that one gang, with Electroline Steel Duct-Rodding Equipment, can make a half-hour job out of one that formerly took two gangs two weeks with old-style equipment!

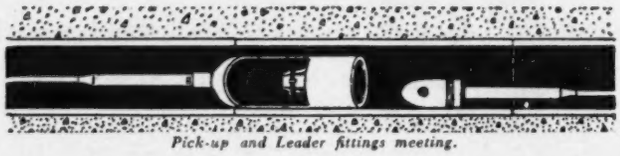
In consequence, they have made amazing savings in labor cost alone. Add to this lower first cost, the lower handling cost, and longer life . . . then you have their reason for adopting Electroline's speedy, economical Duct-Rodding Equipment.

The construction is simple and trouble-free, yet affords the outstanding advantages of easy, efficient rodding and great durability in service.



You can turn days into minutes, too—by speeding up installation and cutting costs with Electroline Duct-Rodding Equipment. Get full details and prices . . . write for a copy of descriptive Bulletin 939.

Thirty minutes or two weeks ?

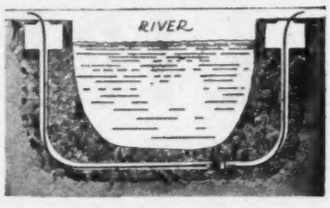


Pick-up and Leader fittings meeting.

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

PATENT APPLIED FOR



Electroline Company

4121 SOUTH LASALLE STREET
CHICAGO, ILLINOIS

ELLIOTT is good on these large high-speed induction motors

A RECENT CENTRAL STATION ADDITION GETS THIS ONE

It's now driving a high-speed boiler-feed pump in the extension of one of the larger utility plants. A typical Elliott two-pole squirrel-cage induction motor, 1750 hp., which incorporates all that Elliott has learned in experience and craftsmanship during a quarter-century of concentration on the building of this type of motor. This particular unit has the Elliott patented "diamond cage" construction which gives high starting torque — one of the design elements that enable these motors to develop new standards in performance.

Elliott motors of this type have pressure lubrication from a built-in unit. Stator frames are cast or welded steel, as desired. Large ventilating channels and ducts in shell and stator core insure cool, quiet operation. Structural design provides unusually high strength and rigidity at high speeds. Descriptive bulletin on request.

ELLIOTT COMPANY

Electric Power Dept.

RIDGWAY, PA.

DISTRICT OFFICES IN PRINCIPAL CITIES

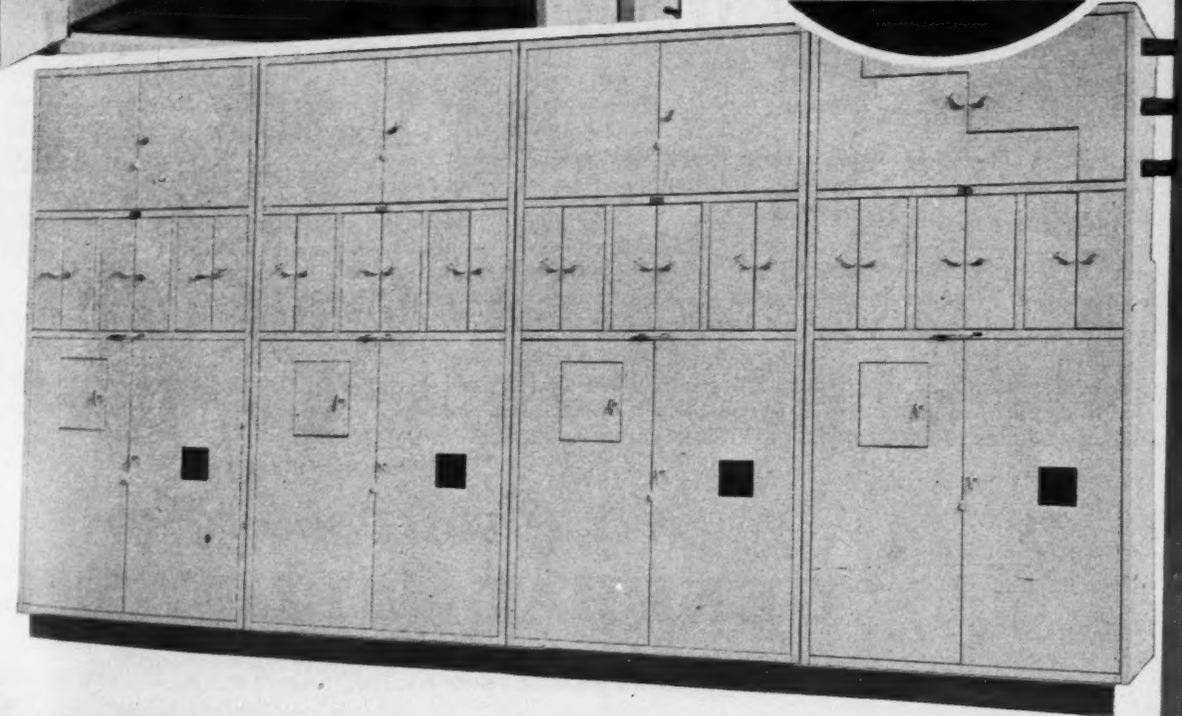
ELLIOTT MOTORS express the latest thought in motor design

CHECK the FACTS

OPEN SECTION—of right hand panel shown below.
Features—rigid welded frames; flanged beaded edge doors with wide angle hinges,—special, resilient metal bus support construction, well fitted, neat appearance.

1. Your requirements are individual problems. . . . **We build what you want.**
2. R&IE is especially capable of furnishing the custom job.
3. We have complete facilities—Engineering talent, manufacturing experience, foundry, machine and steel shops—all under one roof.

R&IE METAL CUBICLES



The Check List

- CONDUCTOR SUPPORTS CLAMPS AND FITTING
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
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- ✓ METAL CUBICLES
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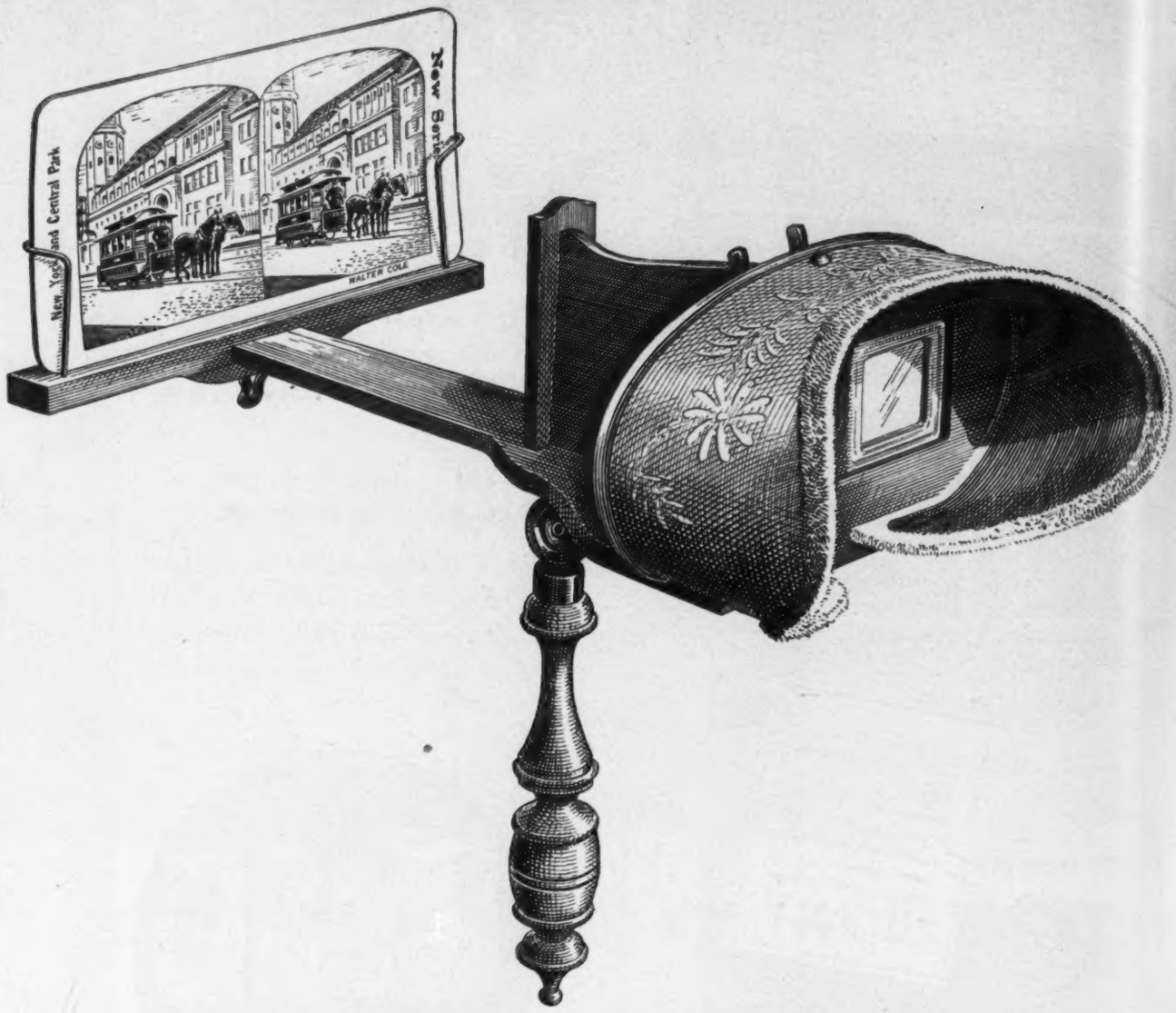
IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO



THIS? A WAR WEAPON?

Remember the old-fashioned stereoscope — grandfather's substitute for the movies? Remember how it made pictures stand out in three-dimensional relief?

Well, the same idea is being used in stereoscopic airplane cameras today. Because stereoscopic pictures show up hidden depressions and hills that are not always apparent in the usual aerial photograph.

Grinding stereoscopic lenses, in fact, *all* highly-corrected lenses, is a delicate precision operation. In order to insure accurate measurements and to avoid uncontrolled expansion, lenses are tested in special *air conditioned* rooms . . . maintaining a constant temperature at all times.

Air conditioning is used similarly in making the famous Norden bombsight, in precision machining, and in many other industrial processes.

To do exacting war jobs like these, General Electric engineers have developed dependable air conditioning and industrial refrigeration equipment—equipment that had to be more efficient, more compact, and more flexible.

In the post-war period, the public will be enabled to buy not only new—but vastly improved air conditioning—from General Electric.

☆ BUY WAR BONDS ☆

General Electric Co., Air Conditioning and Commercial Refrigeration Divisions, Section 4310, Bloomfield, New Jersey.

Air Conditioning by

GENERAL ELECTRIC

Hear the General Electric Radio Programs: "THE HOUR OF CHARM," Sunday 10 P. M. EWT, NBC..."THE WORLD TODAY" News Every Weekday 6:45 P. M., EWT, CBS

How to Cut Corners In Line Construction Without Cutting Corners On Quality

UNIVERSAL STRAIN CLAMPS

SUSPENSION INSULATORS

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ANGLE CLAMPS

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INSULATED CLEVISES

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STRAIN INSULATOR FITTINGS

Graybar Distributed by Graybar Electric Company

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONTARIO

There's a lot of know-how in making insulators and line hardware. This class of material distributed by Graybar is a product of the Ohio Brass Company, one of the leaders in the electrical industry. Ingenious designs that save time and labor are based on long experience. Materials are the same as employed in the highest voltage applications. They add up to all-around satisfaction. And the difference between time-proven materials and unknown "bargains" is so slight that just one trouble call will wipe it out. You won't make that call when you build with O-B. Get these materials from Graybar—as handy as your 'phone.

2439-H

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

War isn't all

OUT OF WAR'S RUTHLESS DEMAND FOR HIGHER AND HIGHER EQUIPMENT. HERE ARE A FEW FROM ALLIS-CHALMERS . . .

☛ World's biggest "wringers" give the first squeezes to arc furnace ingots on their way to flawless plate for modern welded-together invasion equipment. Back and forth, a 7000 hp reversing motor passes the ingot through the blooming mill rolls—one reversal every 1¼ seconds!

Formerly, it took 40% more time to reverse big blooming mill motors than it does today with Allis-Chalmers "Regulex" exciter, wide-range, acceleration-and-deceleration control.

REGULEX EXCITER SET FOR ARC FURNACE CONTROL

Stepping up of production-speed of mills and furnaces—without building them bigger—is what "Regulex" control is doing for the war. More and more steel mill men are now demanding "Regulex"—star performer in Allis-Chalmers line of electric power control.

Postwar possibilities of the "Regulex" exciter are tremendous!

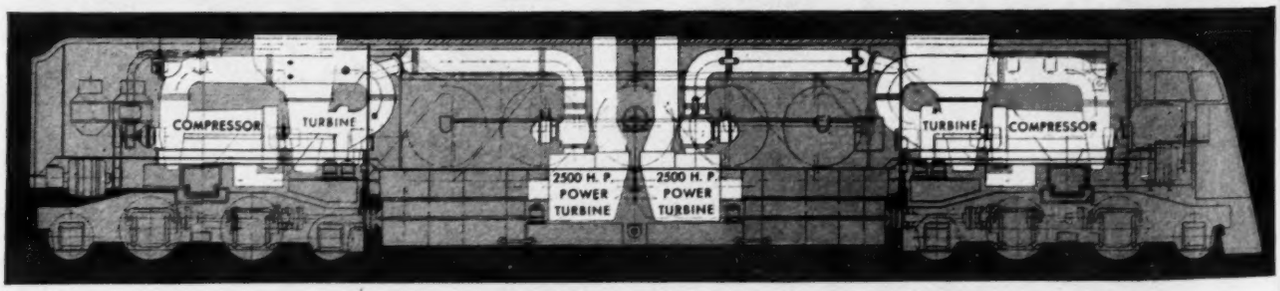
☛ Because of minimum operating costs, small size and weight per unit of power, absence of water—gas turbine power units have already been installed on the drawing board in a 5000 hp, 120 mile per hour locomotive. See below.

Here two 2500 hp units equalize weight on front and rear drivers. Each has two gas turbines, one to keep proper speed on compressor, the other to drive the wheels through a hydro-mechanical transmission.

Moral: The gas turbine—power plant of the future—is economical and compact enough to fit on wheels!

☛ Electronic power—lightning in leash—flows in tanks of mercury arc rectifiers to convert alternating current to direct current.

Every 360th of a second—218 million times a week—rectifiers must "fire" precisely at the right moment. In Allis-



PROPOSED 5000 HORSEPOWER GAS TURBINE DRIVEN LOCOMOTIVE

A-C WE WORK FOR VICTORY WE PLAN FOR PEACE

ALLIS-

destruction..

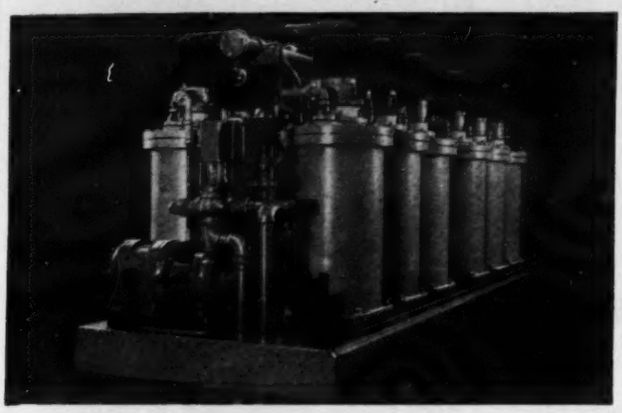
EFFICIENCIES COME NEW IDEAS IN POWER AND ELECTRICAL

NEW GRIST FOR THE MILLS OF POST-WAR PLANNERS. . . .

Chalmers "Excitron" rectifiers a pilot arc of only 1/150th of the main arc keeps the main arc "primed," without contributing to arc-backs. This continuous pilot excitation system is what makes "Excitrons" stable . . . keeps them "firing" for war production!

Biggest wartime use for electronically rectified d-c is in the electrolytic reduction of aluminum and magnesium for planes, production of chlorine gas.

Tomorrow? "Excitrons" are now being groomed by Allis-Chalmers engineers for uses other than a-c/d-c conversion, looking to an age of electronic power!

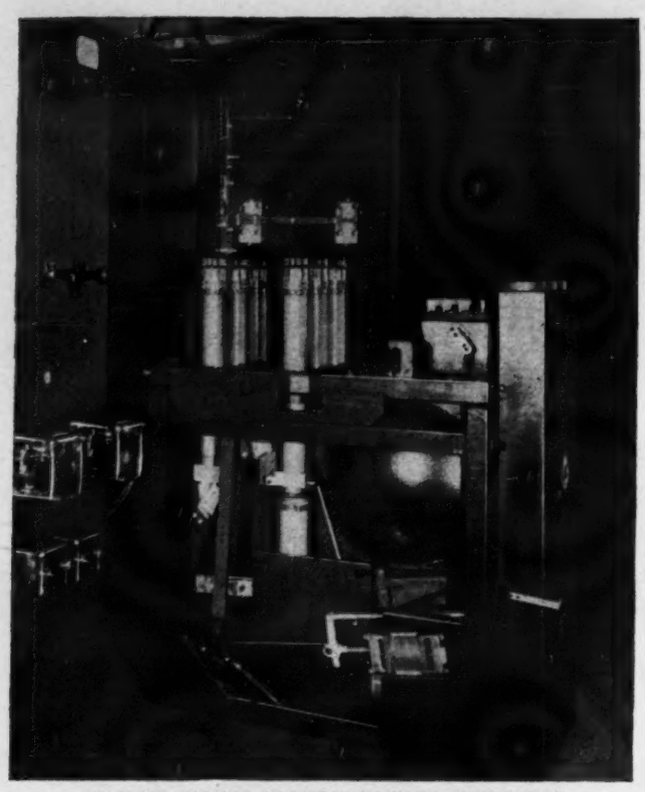


12-TANK "EXCITRON" RECTIFIER

☛ War's demand for higher efficiencies is giving new prominence to Allis-Chalmers air blast circuit breakers.

Reason: Arcing time of air blast breaker is always less than 1/2 cycle . . . that is, at the next current-zero of the 60-cycle wave after contacts part, arc "is out", to stay. Contact life is amazing . . . protection is complete.

Air blast principle: 1) prestored high pressure dry air released to breaker manifold forces piston contact back from



AIR BLAST BREAKER IN METAL-ENCLOSED SWITCHGEAR

orifice, 2) arc is drawn and vanishes with the turbulent air through the hole, 3) Arc products, too, have vanished . . . precluding reignition of arc. All this happens in less than 1/120 of a second.

Note on reliability: steel mills, where reliability is perhaps at its highest premium, are becoming more and more interested in air blast breakers.

Look for other important new developments in electrical and power equipment from Allis-Chalmers. Maybe we can help you—maybe you can help us. ALLIS-CHALMERS, MILWAUKEE, WIS. A 1632

-CHALMERS

ALWAYS
READY FOR USE

*THE NEW "MEGGER"**
INSULATION TESTER . . .

a worthy addition to the famous "MEGGER" family!

MADE IN U.S.A.

- HAND-CRANKED GENERATOR
- DIRECT-READING OHMMETER
- SIMPLE
- RUGGED
- RELIABLE

*Trade Mark Reg. U. S. Pat. Off.

With our Philadelphia factory now in full production, your needs for "Megger" Insulation Testers can soon be met.

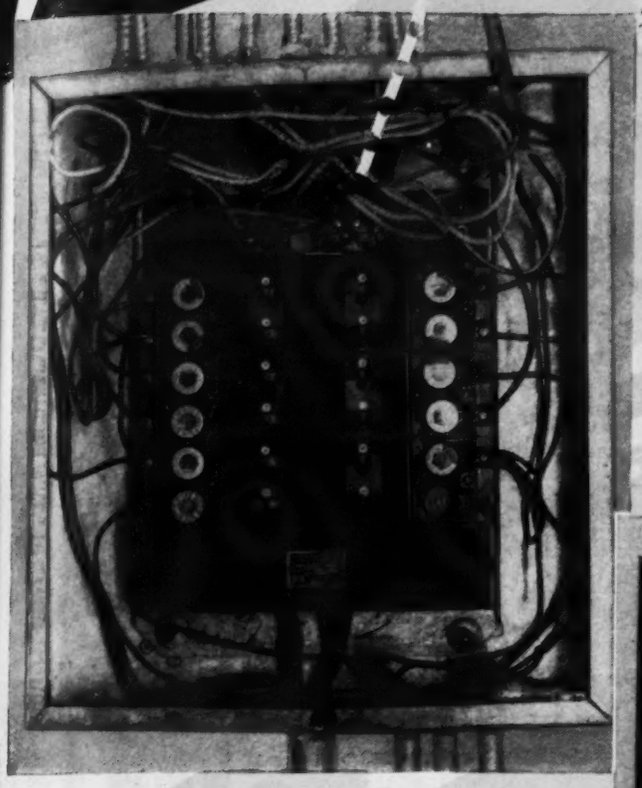
Our new U. S. models are of the same general design and are similar in every way to our well-known "Meg" and "Super-Meg" Insulation Testers, except that they are housed in plastic molded cases instead of aluminum. All internal parts are made to the same proven design and specifications as the "Meg" instruments,—without compromise or substitution of materials. The cases are of high impact strength plastic,—one of the strongest, toughest molding materials available.

The entire instrument is built in our own plant by men and women who know how to make fine instruments. Our production is independent of the products of other instrument manufacturers.

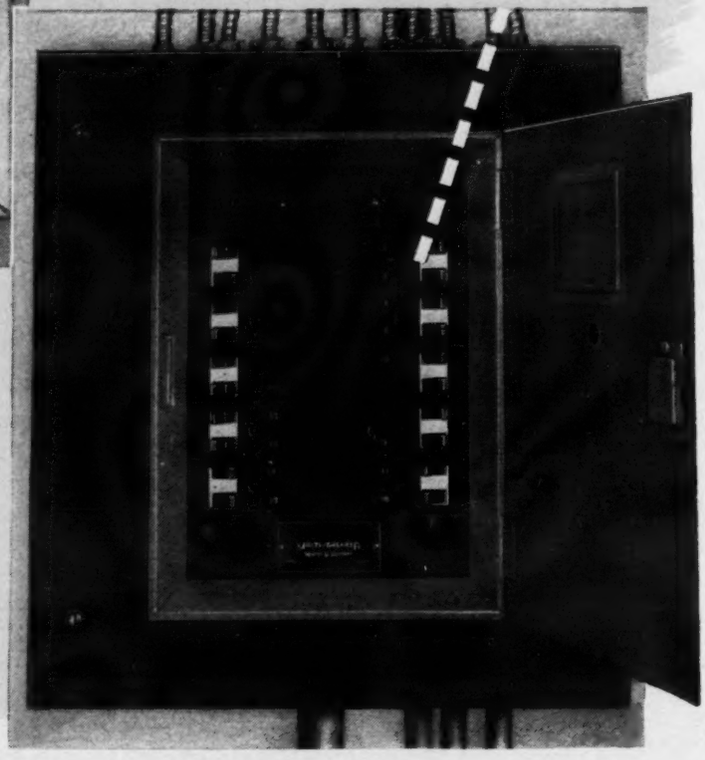
We are fully confident that you will find these new Insulation Testers worthy members of the famous "Megger" family, and we invite your orders for them. At present we are offering ranges up to 100 and 1000 megohms with 500-volt generators. We continue to supply various other types and ratings of "Megger" instruments as formerly. Write for new descriptive Bulletin 1735-W.

JAMES G. BIDDLE CO. · 1211-13 ARCH STREET · PHILADELPHIA 7, PENNA.

Problem AND Solution



Problem: An obsolete and overloaded fusible type panel. It provided only 12 lighting and power circuits. More were needed.



Solution:
A new Square D Multi-breaker panelboard, installed in the old box, using the same conduit. Provides 20 circuits . . . 66⅔% more capacity.

Multi-breaker lighting and distribution panels, when installed in existing panel boxes, usually increase the number of circuits by more than 50%. They eliminate fuses completely . . . provide modern convenience and protection. There are literally hundreds of plants that can profit tremendously by such conversion . . . right now.

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Let operating conditions determine the type of transformer you require

TRADE MARK

Standard

BUILDS THEM TO YOUR SPECIFICATIONS *In...*

ASKAREL

● 2500 KVA, Type HT, Askarel filled transformer, 60 cycle, three phase, 4160 V. delta primary with two 2½% taps above normal and two 2½% taps below normal, 460 V. delta secondary; complete with standard accessories, winding temperature indicator, and magnetic oil gauge with low level alarm contacts.

THE STANDARD TRANSFORME

● When you buy a transformer—buy it to meet a specific operating condition. Standard Transformer engineers have found from experience that longer service—and ultimately lower costs are obtained when the transformer is designed and built to cover an individual condition.

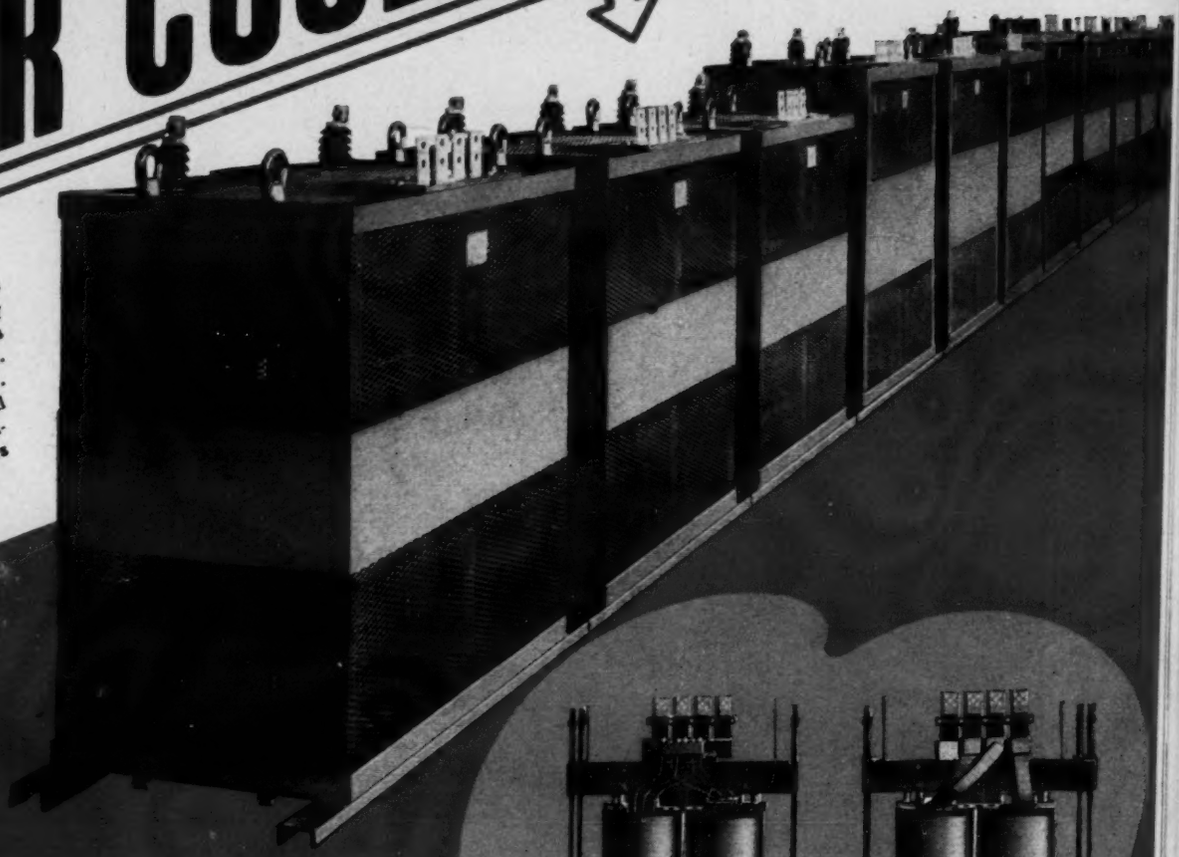
Perhaps you can save long runs of secondary copper, improve machine efficiency in the plant by locating a transformer close to the load center, you decide an Askarel type transformer will do the job. Standard will build it.

On the other hand, if floor space and safety regulations call for an air-cooled transformer,—Standard will build it to meet your specific need.

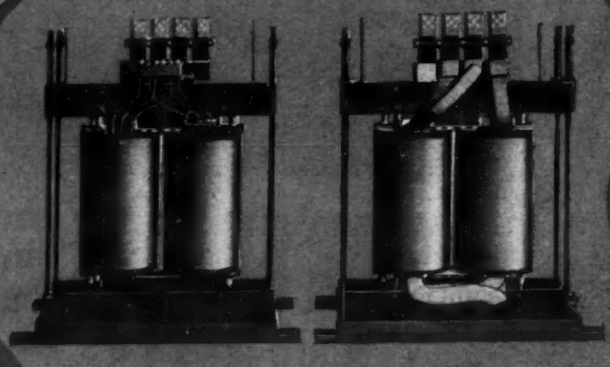
Our experience in the design and construction of all types of transformers—our modern manufacturing facilities—our complete engineering organization—enables us to move quickly and efficiently on all transformer requirements.

If you would like the help of one of our engineers in determining which type of transformer is best suited to your needs—write or wire Standard Transformer Company, Warren, Ohio.

nd AIR COOLED TYPES...



hipment of 12 Type MG. 200 300 KVA and 400 KVA dry air cooled, natural draft, glass ated transformers, 75 deg. C. 60 cycle, single phase, 4160 V. ary 120/240 V. secondary. All erminals are enclosed in term- chambers when transformers installed.



Core and coil structure, front and back view, of 400 KVA, Type MG, dry type, air cooled, natural draft, glass insulated transformer, 75 deg. C. rise, 60 cycle, single phase, 4160 V. primary, 120/240 V. secondary.

OMPANY, *Warren, Ohio*

CONTACT PRESSURE LIFTS IS TIMES THE RELAYS' WEIGHT

DUNCO'S LITTLE GIANT OF THE RELAY FIELD

Ordinary relays weighing, say, one pound, may give a contact pressure of 3 or 4 ounces.

By comparison, the Struthers-Dunn Series 61 D.C. Relays give 7 *pounds contact pressure in a unit weighing only 8 ounces!* Moreover, these famous Dunco "Nutcrackers" are especially designed to withstand shocks and vibration, and to operate faithfully without an enclosure in dirty or dusty places.

Although designed for D. C. use, their contacts will also handle A.C. They are supplied in various single and double pole types and are specifically recommended for any low-voltage d-c service where exceptionally strong contact pressure is desirable to secure maximum resistance to shock.

RELAY GUIDE SENT ON REQUEST

You'll find these Series 61 Relays described on Page 29-F of the Dunco Catalog and Relay Data Book. Copy gladly sent on request to interested users.

STRUTHERS-DUNN, Inc.

1321 ARCH STREET, PHILADELPHIA, PA

DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • HARTFORD • INDIANAPOLIS • LOS ANGELES • MINNEAPOLIS • MONTREAL • NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

only 20% of RURAL OUTAGES NEED OCCUR

..the OTHER 80%* ARE CAUSED BY TEMPORARY FAULTS WHICH MAY BLOW FUSES BUT COULD BE CLEARED, AND SERVICE IMMEDIATELY RESTORED WITH

PACIFIC ELECTRIC'S
Single Pole MOTOR REWOUND AUTOMATIC *Service Restorer*

For Rural Single-Phase Distribution Lines and Feeders. Type AE-1, 15-kv., 50-amps., 1200-amps Interrupting Rating. Patent Pending.

Temporary faults, which may blow fuses, cause 80% of rural outages.

You can clear such faults immediately and restore service automatically with the Pacific Electric Spring-Actuated Motor-Rewound Automatic Service Restorer.

Your lines are protected on sustained faults because it locks out after the third reclosure.

With its consistent TIME and CURRENT adjustments, coordination with fuses and breakers confines sustained faults to immediate areas.

It has the Expulsion Chamber for fast arc extinguishment, alternate manual operation, full enclosure for safety and it has passed successfully seven major design tests. Ask for full details on the Single-Pole Automatic Service Restorer which clears 80% of rural faults.

*Average preventable outrages as published in surveys.

Easy to Coordinate—wide range of trip coils available for coordination with fuses and breakers.

Lower Maintenance—permits high-quality protection of low-cost systems.

Reliable, Low Cost—will clear immediately any number of transient faults; on sustained faults, offers 3 reclosures then lockout. Operating energy stored in a spring which is tripped to cause operation.

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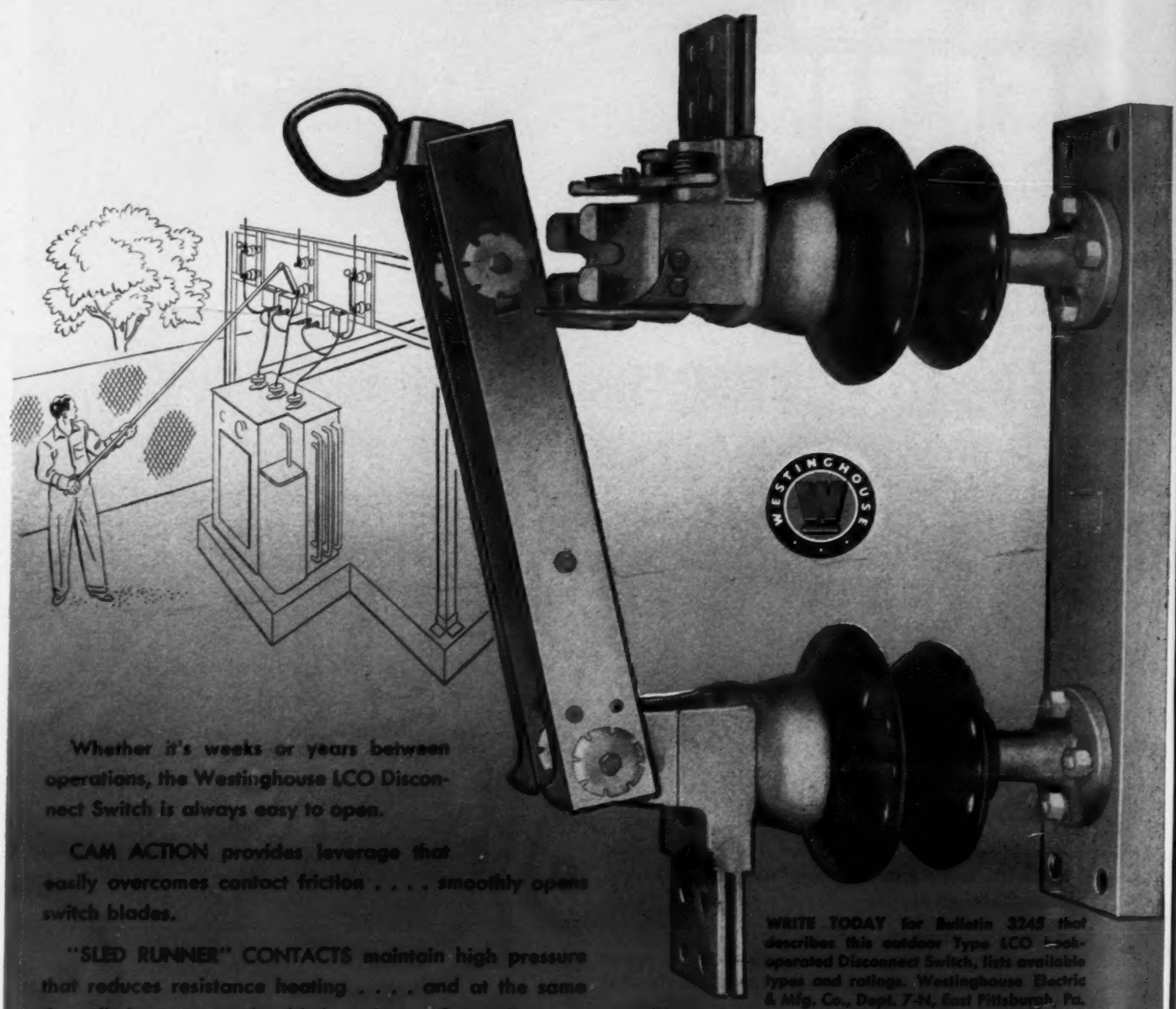
THE WESTINGHOUSE LCO OUTDOOR DISCONNECT SWITCH

always *Easy to open* ...yet locked when shut



Whether it's weeks or years between operations, the Westinghouse LCO Disconnect Switch is always easy to open.

CAM ACTION provides leverage that easily overcomes contact friction . . . . smoothly opens switch blades.

"SLED RUNNER" CONTACTS maintain high pressure that reduces resistance heating . . . . and at the same time eliminates excessive friction of large flat surfaces.

When closed, a latch securely locks the blades . . . . prevents accidental opening even under severest short circuit conditions. A slight pull on the hook-eye quickly releases the latch.

J-60540

WRITE TODAY for Bulletin 3245 that describes this outdoor Type LCO hook-operated Disconnect Switch, lists available types and ratings. Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

DISCONNECT SWITCHES

Bus Conductors of Copper power essential industries . . .

HERE'S WHY!

Because of its high conductivity and consequent low current losses, copper has always been the most widely used material for bus conductors.

To these advantages may be added such further qualifications as high thermal conductivity, high strength, high resistance to corrosion and ready availability of accessory equipment. It is for these reasons that copper lends itself to more efficient bus constructions.

Wherever modern electrical engineering practice dictates bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the range of copper bus shapes made by The American Brass Company will meet every requirement, for, in addition to a complete line of copper bus bars of rectangular shapes, this Company makes high conductivity pipe and tube, stranded cables and special shapes.

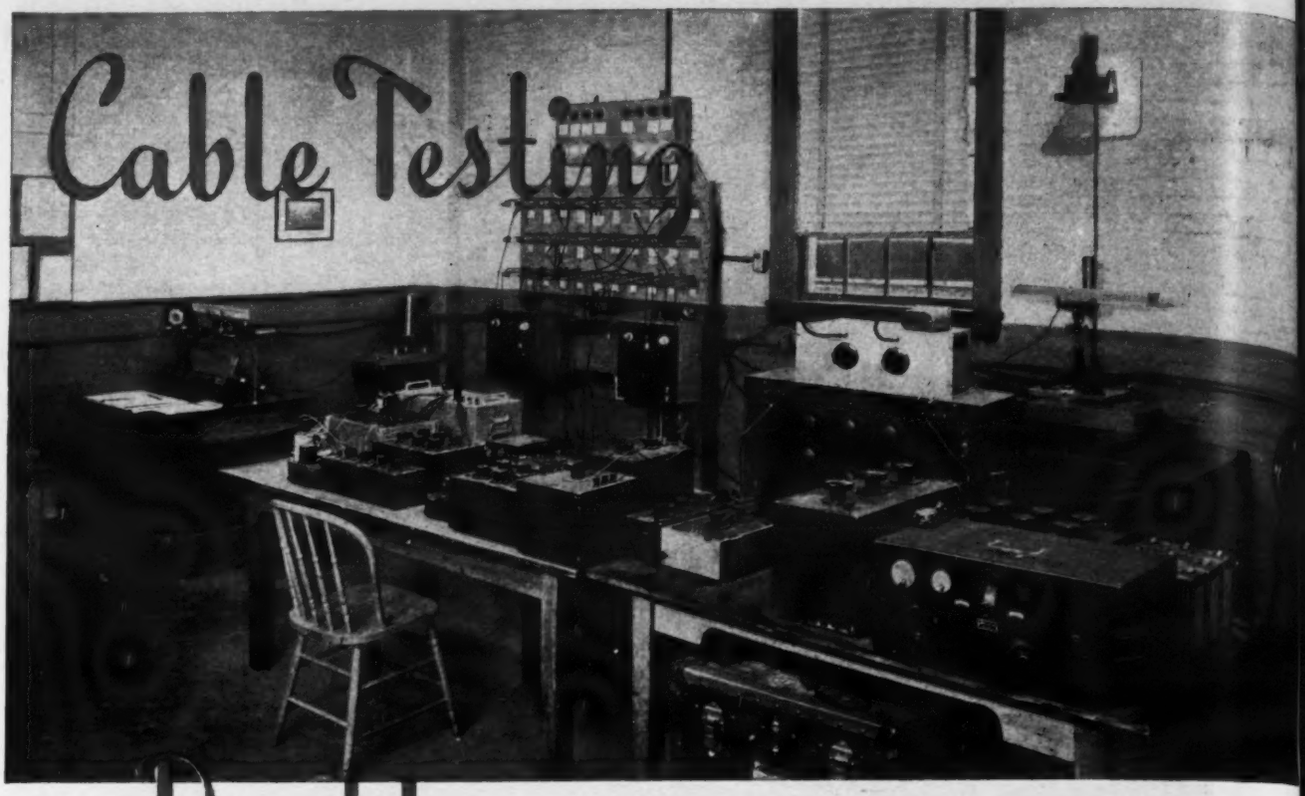
Of particular interest to electrical engineers are the hollow ventilated busses made from channels, angles and rectangular copper bars. Technical information, including the suggestions of our Engineering Department on various bus conductors and assemblies, is available on request. 43101

ANACONDA
from mine to consumer

Anaconda Copper

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

Subsidiary of Anaconda Copper Mining Co. • In Canada: Anaconda American Brass Ltd., New Toronto, Ont.



IS Doubly IMPORTANT NOW . . . .

The excellence that has for many years distinguished Simplex insulated wires and cables has not been accidental. It was the natural result of careful supervision of materials and processes supplemented by both routine and special electrical tests during manufacture. Electrical tests are doubly important now because of restrictions limiting the use of scarce, critical materials.

If you are engaged in essential war work and need cables engineered to fit your operating conditions, it will be worth while for you to learn what Simplex controlled quality may mean for you.

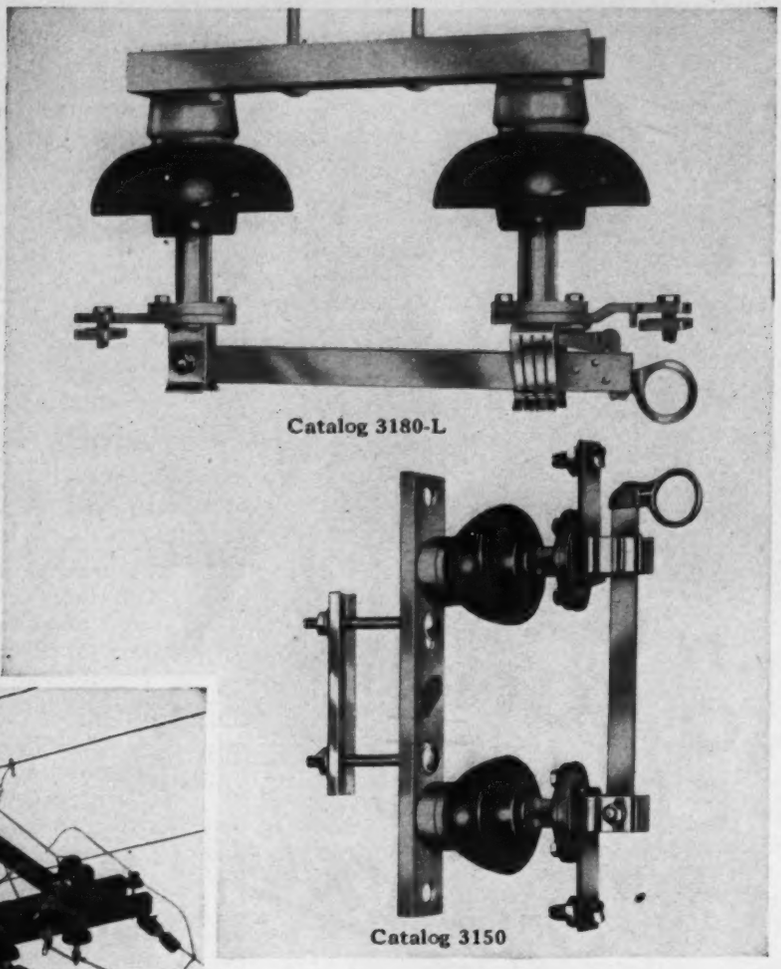
Simplex insulated wires and cables conform to government specifications and regulations but to maintain Simplex quality while meeting these unusual war-time limitations we have at times found it necessary to assemble special testing equipment for unusual, out of the ordinary, tests. The results have more than justified the extra work. Simplex quality is being maintained.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex WIRES and CABLES

OPEN TYPE
MATTHEWS DISCONNECTING SWITCHES

Adaptable for Horizontal or Vertical Mounting



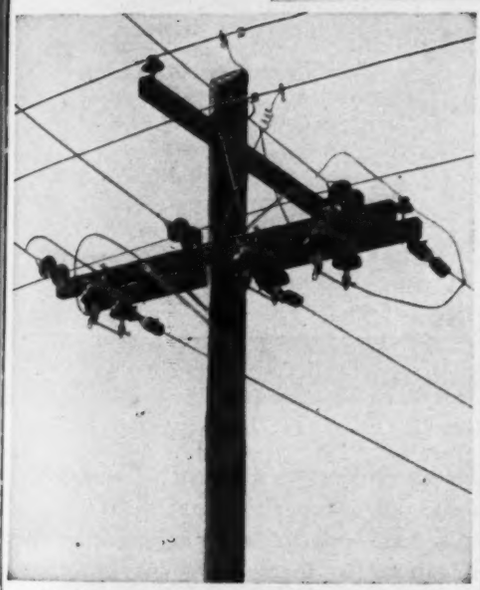
Catalog 3180-L

Catalog 3150

High Quality Materials Mean Lowest Time-Cost

•

No Radio Interference at Rated Voltage



Shows installation of Catalog 3158 Matthews Disconnecting Switches.

Matthews Disconnecting Switches are made in 200 and 400 Ampere sizes and 7.5, 15 and 23 Kv. Ratings.

Write for Bulletin 106
It gives complete information.

Where cost of equipment is limited due to low revenue lines, these low-cost, substantially constructed, hot stick operated Matthews Disconnecting Switches will meet your needs for economical and efficient operation.

Special insulators of our own design, have ample electrical values for their respective ratings in accordance with NEMA Distribution CUTOUT Standards, Publication 38-53. Galvanized certified malleable iron caps and pins are securely cemented onto insulators in accordance with our 96-hour natural cement curing process which has given perfect satisfaction in the field for over twenty years.

All current carrying parts are of at least 85% copper content material; all other metal parts are hot galvanized.

The 200-ampere Disconnecting Switches are equipped with single, heavy bus bar copper blades, while the switches rated 400 amperes have double blades. All can be furnished with blade latches, as illustrated, at additional cost.

Female contact clips of bus bar copper, reinforced by spring phosphor bronze retainer clips, assure positive contact with no overheating, at full rated load.

W. N. MATTHEWS CORPORATION
SAINT LOUIS, U. S. A.
ENGINEERS and MANUFACTURERS SINCE 1899

Property Records CAN NO LONGER BE CALLED "Non-Productive"

Here's Why:

Shown here is a complete Kardex Continuing Inventory of some 40,000 poles —plus all overhead transmission and distribution property located thereon.

This *thorough* type of record not only helps Utility Companies meet the capital investment requirements of many Public Service Commissions *but gives the Engineering Department a valuable operating record as well.*

Nearly ten years ago, the New Hampshire Gas and Electric Company developed and adopted a method of recording their physical property units, utilizing Remington Rand Kardex equipment.

In the words of that Company's Treasurer: "This Kardex system has proven a most satisfactory and economical method . . . not only in complying with the Public Service Commission accounting requirements, but also in providing essential operating and statistical information."

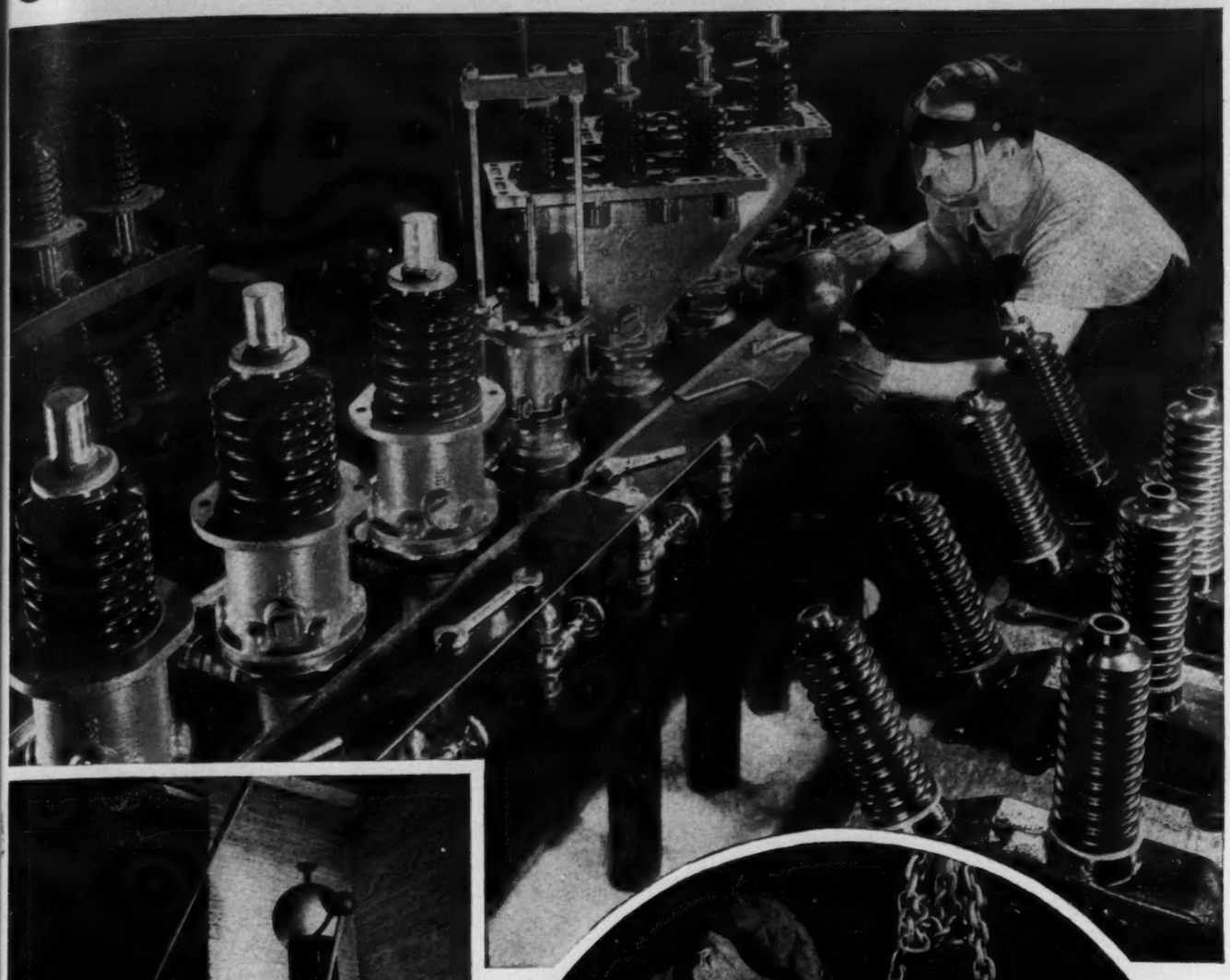
They add: "We recommend a study of this system, utilizing Kardex equipment, to any company proposing to establish Continuing Property Records."

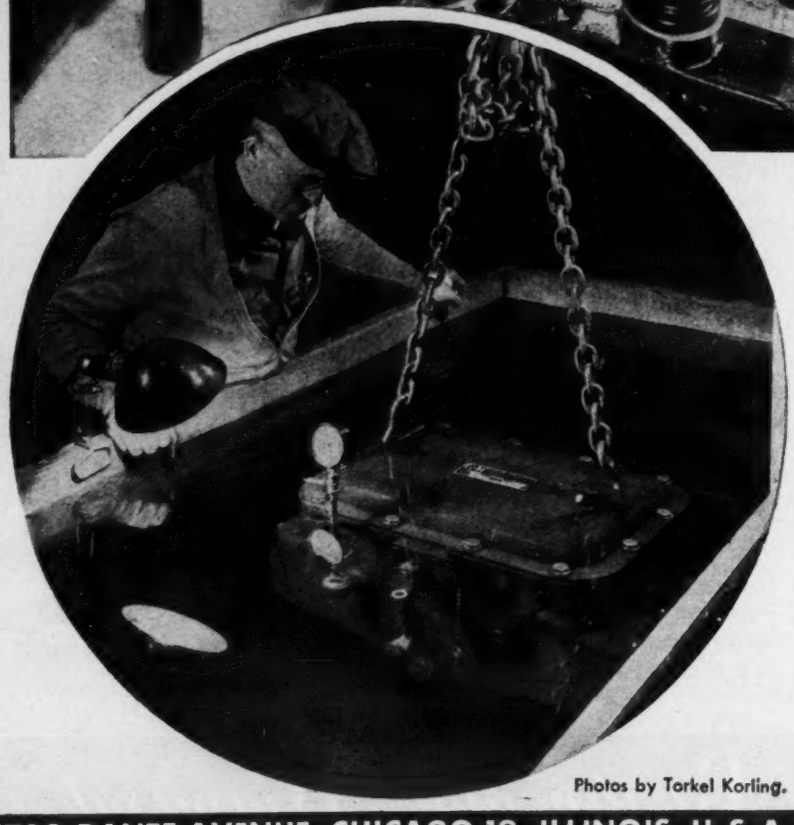
What Kardex has done for so many other Public Utilities organizations in the way of *instantaneous*, visible, accurate record control, Kardex can do for you. May we place in your hands a copy of the Management Controllers 599 and 636?

They give you a clear picture of the tremendous value of Kardex in the Public Utilities field. Just drop a line to our Buffalo Office or phone your nearest Remington Rand Branch Office (listed in your phone book).

REMINGTON RAND
BUFFALO 3, NEW YORK

G&W FACTORY TESTING SAVES YOU TROUBLE





Factory testing of products is routine with G & W.

- Cable boxes, oil switches and cutouts must be air-tight, water-tight and oil-tight. To make sure that these devices are definitely tight, G & W tests them under water with 15 to 20 pounds air pressure.
- Cable potheads must remain tight at all temperatures in service. To insure positive oil and moisture tightness, they are given a test with thin oil at 170° F. under 30 pounds per sq. in. pressure.
- Electric tests are also an important part of the G & W manufacturing process. You can make sure of good quality by ordering and specifying G & W cable terminating and sectionalizing devices.

Photos by Torkel Korling.

G & W ELECTRIC SPECIALTY CO., 7780 DANTE AVENUE, CHICAGO 19, ILLINOIS, U. S. A.

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS

THE ability to get things from where they are made to where they are needed has been the key to our success in this War. Transportation will play an equally important part in building the Peace to come. The shadows of progress are again lengthening and pointing to air transport as the future's answer to local and World Commerce.

C-D has served effectively in helping produce our Military Aircraft. Vulcanized Fibre, and DILECTO and CELORON plastic parts, are used throughout fuselages, radio sets, controls, electrical systems, fuel systems, ventilating systems. Many of these parts were designed for their jobs by C-D Engineers. The accumulated "know how" of almost a half century of experience with these basic NON-metallics, has helped many designers solve difficult material and design problems.

This same wealth of information and data are available to help you solve your "What Material?" problem. Send today for booklet GF—entitled "What Material?".

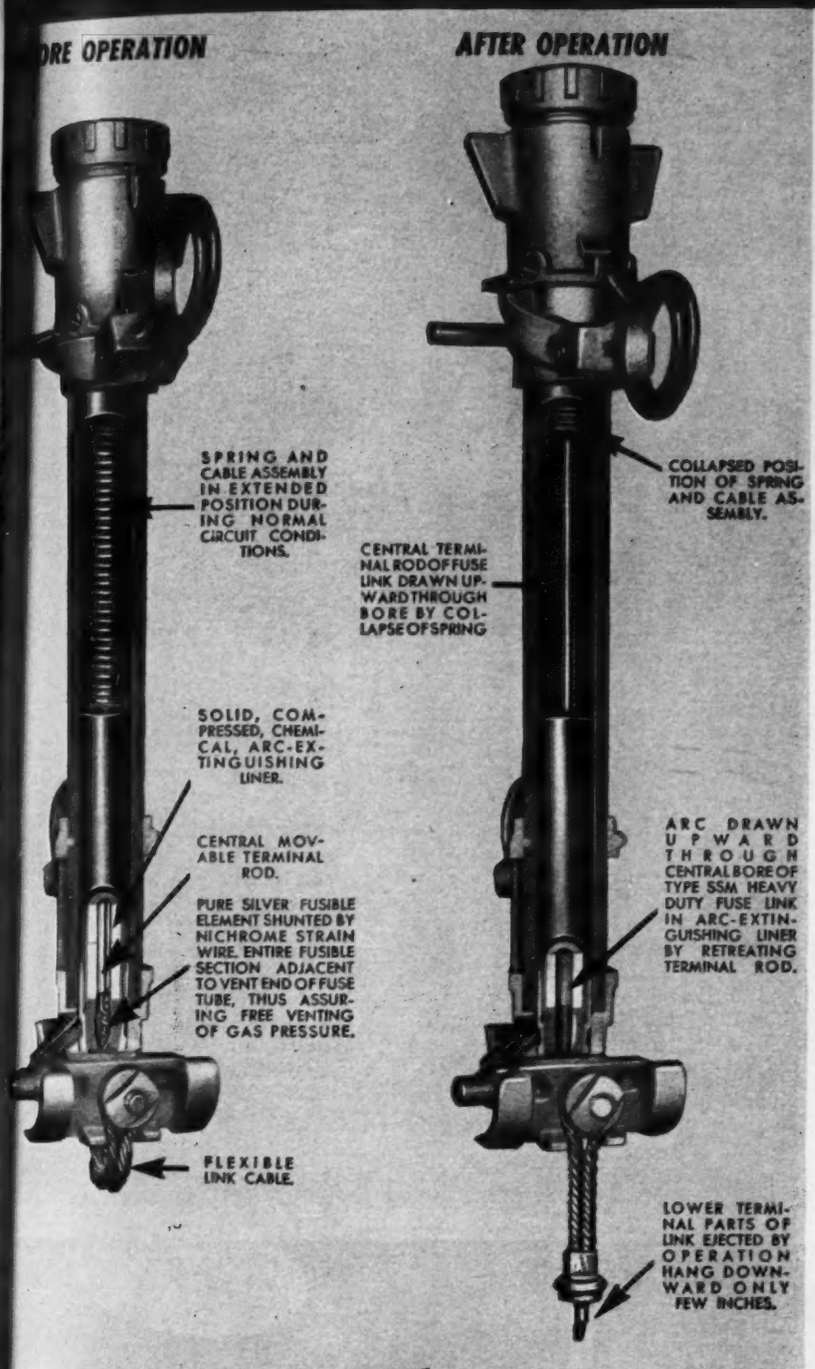
C-D products include THE PLASTICS . . . DILECTO—*a laminated phenolic:* CELORON—*a molded phenolic:* DILECTENE—*a pure resin plastic especially suited to U-H-F insulation . . .* THE NON-METALLICS, DIAMOND *Vulcanized Fibre:* VULCOID—*resin impregnated vulcanized fibre: and* MICABOND—*built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.*

DISTRICT OFFICES: New York • Cleveland • Chicago • Spartanburg, S. C.
West Coast Representative, Marwood, Ltd., San Francisco
Sales Offices in principal cities

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

THOUSANDS USED
ON PLANCOR JOBS ALONE


ORE OPERATION
AFTER OPERATION
SPRING AND CABLE ASSEMBLY IN EXTENDED POSITION DURING NORMAL CIRCUIT CONDITIONS.
COLLAPSED POSITION OF SPRING AND CABLE ASSEMBLY.
CENTRAL TERMINAL ROD OF FUSE LINK DRAWN UPWARD THROUGH BORE BY COLLAPSE OF SPRING
SOLID, COMPRESSED, CHEMICAL, ARC-EXTINGUISHING LINER.
CENTRAL MOVABLE TERMINAL ROD.
ARC DRAWN UPWARD THROUGH CENTRAL BORE OF TYPE SSM HEAVY DUTY FUSE LINK IN ARC-EXTINGUISHING LINER BY RETREATING TERMINAL ROD.
PURE SILVER FUSIBLE ELEMENT SHUNTED BY NICHROME STRAIN WIRE. ENTIRE FUSIBLE SECTION ADJACENT TO VENT END OF FUSE TUBE, THUS ASSURING FREE VENTING OF GAS PRESSURE.
FLEXIBLE LINK CABLE.
LOWER TERMINAL PARTS OF LINK EJECTED BY OPERATION HANG DOWNWARD ONLY FEW INCHES.

S&C HRSO-3 Heavy Duty Three-Shot Semafor Recloser

For SUBSTATION and POWER FEEDER CIRCUITS

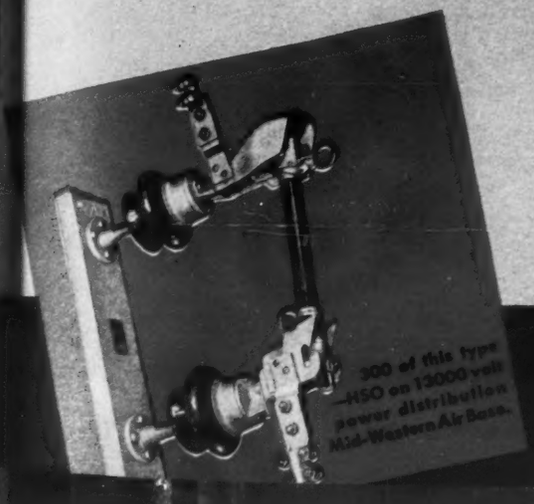
For shell plants, powder mills, chemical plants, rubber mills,—tank, airplane and other vital war industries, thousands of HSO Power Fuse Cutouts were chosen for the protection of substations, power feeder circuits, and heavily loaded branch lines. The widespread and increasing application of these heavy duty cutouts gives further proof of their reliability and high interrupting capacity.

This type fuse employs solid chemical arc interrupting material, resulting in efficient operation under short circuit conditions. (See illustrations).

Single Cutouts and Automatic Recloser Cutouts use the same fuse holders and assembly—the Recloser type providing the benefits of automatic restoration of service after interruption to reduce delays, maintenance time, and expense. The protection provided is equal to that of much heavier and more costly equipment.

For complete details refer to pages 14-19 S & C Bulletin 215. If not available write for a copy.

SCHWEITZER & CONRAD, INC.
4435 Ravenswood Ave., Chicago, Ill.
Manufactured in Canada by Powerlite Devices, Ltd., Toronto, Ontario


300 of this type —HSO on 13000 volt power distribution Mid-Western Air Base.

HEAVY DUTY SEMAFOR CUTOUTS and RECLOSERS

. . . "a bridge of ships

"See-ability"... helps put ships together in record time . . .

America's 1943 output of ocean-going freighters is set at 19,000,000 tons . . . more than double 1942 production.

To attain this goal, scores of supporting industries must continue to contribute their highest skills.

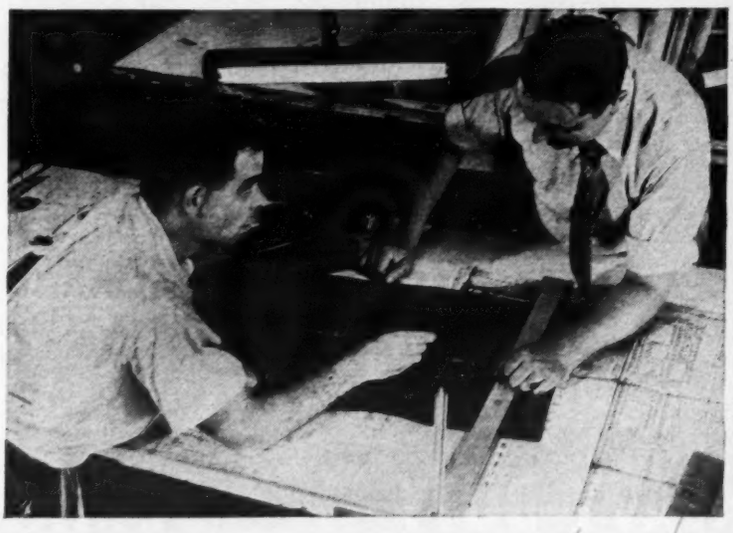
For example, the lighting industry! In shipyards everywhere—in the drafting rooms, the mold lofts, machine shops, and on the ships themselves—"See-ability" is helping men work more accurately and effectively.

Helping men build ships is one of the jobs for which millions of brighter, long-lasting Westinghouse Mazda Lamps are earmarked.

Help war factories get more light

Many of our war factories are busy producing supplies for our armed forces, that their lighting systems get no attention. "See-ability" for workers is thereby reduced. You can help these factories get more light. Suggestions are given in a booklet "See-ability for Indoor Eyes". A free copy is yours for the asking. Westinghouse Electric and Mfg. Co. Lamp Division, Bloomfield, N. J.

KEEP YOUR DOLLARS FIGHTING . . . BUY WAR BONDS



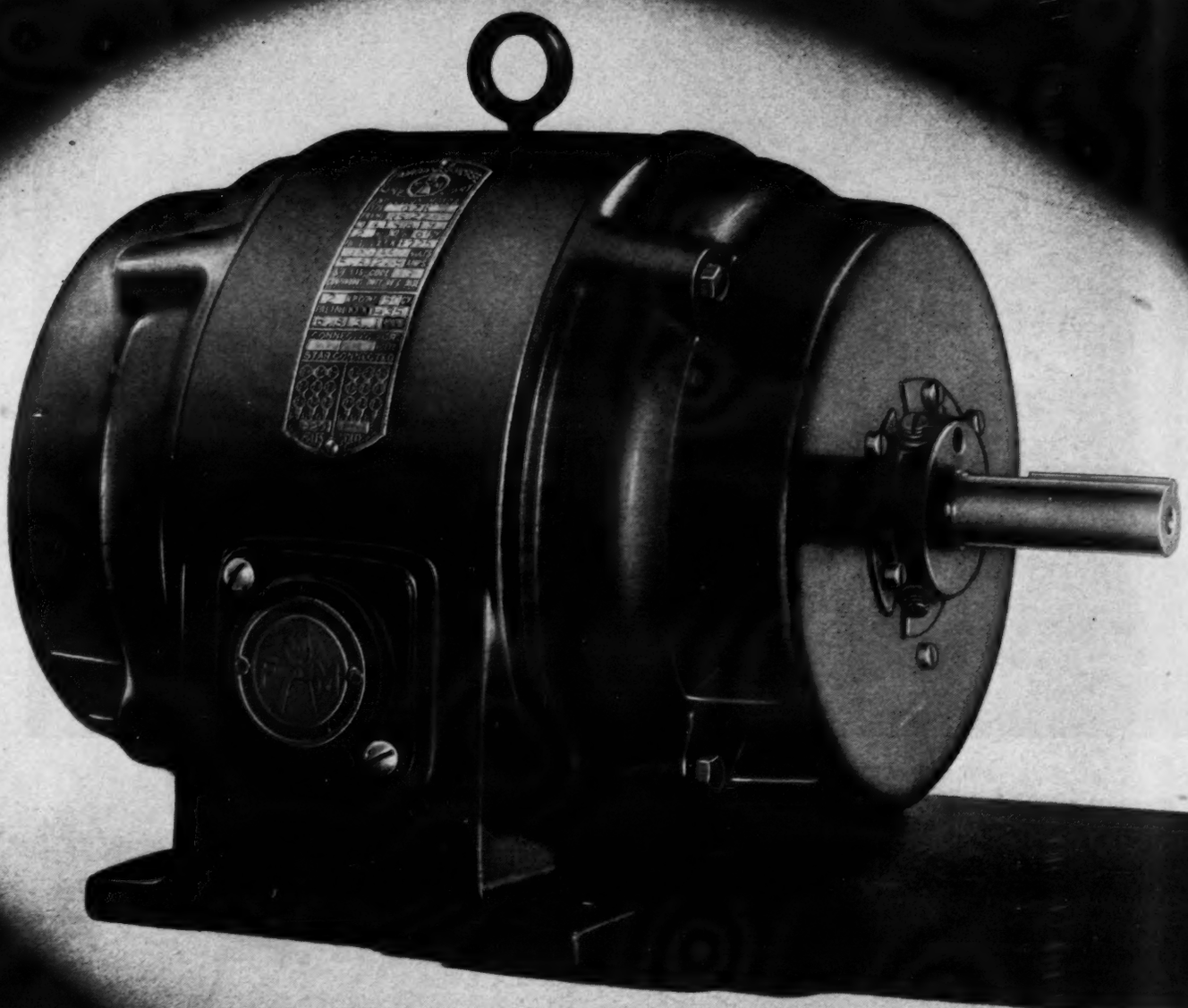
to span the oceans"

Westinghouse

MAZDA LAMPS

FOR BETTER "SEE-ABILITY"

NEW



WITH *Copperspun* ROTOR

FAIRBANKS - MORSE

MOTOR

Here is a motor—different from any you have ever seen.

It is a challenge to future motor design—because it includes more versatility, more stamina, more protection than was ever put into one housing before.

- **It is a 40°C motor—with a ventilating system you will want to know about!**
- **It is a protected-type motor!**
- **It has the most adaptable, convenient, and handiest conduit box you ever laid your eyes on!**
- **It has the famous Fairbanks-Morse COPPERSPUN Rotor!**

A demonstration is necessary to fully appreciate the many unique features of this motor.

You will want to know all about this new Fairbanks-Morse Motor—especially if you are now buying motors for a war task but want them to be up to the minute when the time comes for post-war production.

Write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill., for full information.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
WATER SYSTEMS
SCALES
STOKERS
FARM EQUIPMENT
RAILROAD EQUIPMENT

Motors

Do You See What We See?

We see how to keep up your post war electric load

Yes, we see how to prepare now for the day when peace brings a sudden stop to war production. It is so clear to us that we're spending our own good cash to promote it.

Increase post war commercial use

Our advertising to hotels, restaurants, bakeries, hospitals and institutions is constantly selling them the idea of cooking electrically after the war. They will be prepared to buy Hotpoint-Edison Commercial Electric Cooking Equipment at the first opportunity—the very time this added load will be most welcome to you.

The demand for electric cooking will be further increased when the thousands of chefs, cooks and bakers now in the armed forces return to their jobs; for in the service they are learning the dependability, safety, simplicity and cleanliness of Hotpoint-Edison electric cooking.

Plan ahead — join us now!

Now is the time to make a study of commercial cooking and baking customers in your market. Find what equipment they now have and what will first need to be replaced after the war. Edison General Electric Appliance Co., Inc., 5618 West Taylor St., Chicago, Ill.

For outstanding achievement in War Production

FOUND ONLY IN MODERN KITCHENS

Hotpoint Edison

COMMERCIAL ELECTRIC COOKING EQUIPMENT

BOSTON NEW YORK CITY ATLANTA CLEVELAND CHICAGO KANSAS CITY
DALLAS LOS ANGELES SEATTLE SALT LAKE CITY
CANADA—Canadian General Electric Company, Ltd., Toronto

PIONEER MANUFACTURERS OF ELECTRIC COOKING EQUIPMENT

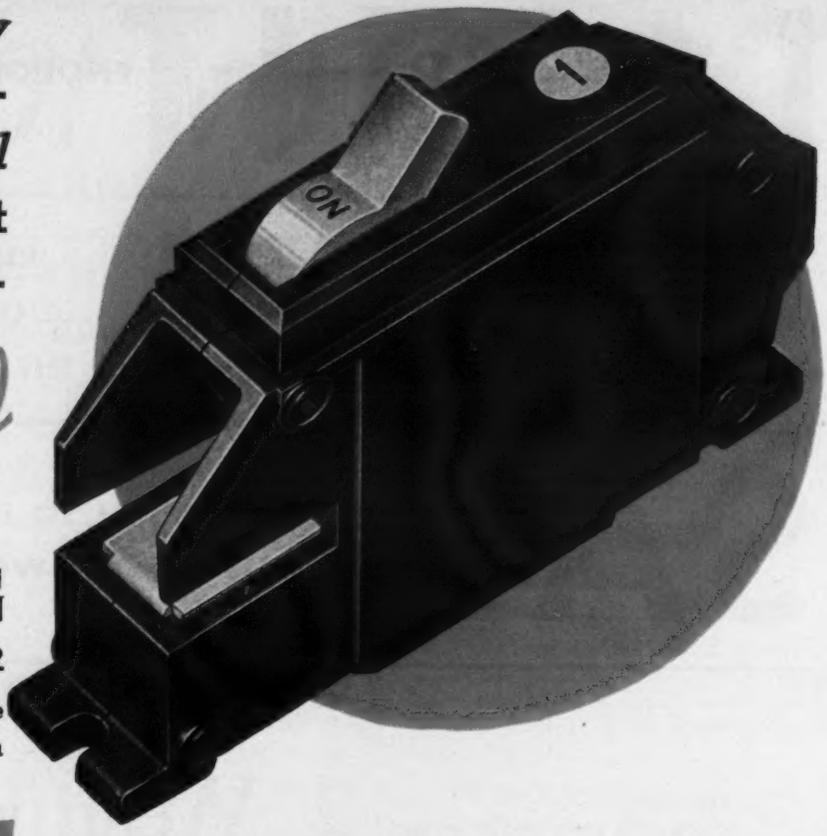
FOR VICTORY — BUY U. S. WAR BONDS AND STAMPS

revents *unnecessary*
terruptions in serv-
e—but provides *full*
***rotection* against**
hort circuit or dan-
erous overloads.

he *Improved*

Type AC
THERMAG
CIRCUIT BREAKER

w combines the time-delay action of the e-tested and proven THERmal trip with fast MAGnetic trip.



ADVANTAGES of the improved Ⓕ Type AC THERMAG Circuit Breaker. (*New and improved features are shown in red.*)

1. Individual pole construction
2. Quick break on manual and automatic trip
3. Tri-metal thermal trip element for time-delay tripping
4. Magnetic trip—for short circuit instantaneous tripping
5. Handle Signal for single pole with automatic reset
6. Signal Button on double pole for trip indicator
7. Magnetic Arc Quencher
8. Line and load contacts recessed
9. Flexible connections between terminals and interior parts safeguard calibration
10. Non-welding type contacts
11. Heavier moulded sections, with air space between sections.
12. Interchangeable with original Ⓕ Type AC Circuit Breaker

The Ⓕ line of equipment for Industry includes: Busduct, Wire and Cable Duct, Panelboards, Switchboards, Safety Switches, Knife Switches, Fan Hanger Outlets, Floor Outlet Boxes, and related equipment.

On harmless momentary overload, the time lag characteristics of the thermal element prevent interruption of service, but trip on sustained, harmful overload. On short circuit, the magnetic element causes *faster tripping* of the circuit breaker.

In meeting and passing the tests of Underwriters' Laboratories, Inc., for interruption of a current of 5,000 R. M. S. Amps., at rated voltage and at 45-50% P. F., oscillograms show that a 15 Amp. Ⓕ Type AC THERMAG Circuit Breaker opened the circuit in .25 of a cycle.

When tripped, the handle on the single pole breaker automatically returns to the OFF position, thus indicating the current interruption . . . On the double pole breaker, a red signal button is protruded from the face of the breaker on which the trouble has occurred.

Ⓕ THERMAG Circuit Breakers are now furnished in all Ⓕ standard and narrow column type panelboards, and in dust-tight panelboards *at no additional cost* . . . Capacities: 50 Amps. or less, 120 volts AC, single or double pole (individual trip). Sturdy construction renders Ⓕ THERMAG Circuit Breakers, assembled in Ⓕ Panelboards, ideal for industrial use.

Installation and connection are facilitated by new and improved Ⓕ Pressure Connectors, wide gutters and ample knockouts in steel boxes. Fronts are bonderited to prevent rusting, and attractively finished in pearl gray lacquer.

EST. THE SIGN OF A FA 1891 BETTER JOB
Frank Adam
ELECTRICAL PRODUCTS
for War Industry
FRANK ADAM ELECTRIC CO.
ST. LOUIS, MO. U.S.A.

LIGHT — ENOUGH TO MOUNT ON A SHELF

SMALL — ENOUGH TO FIT ANYWHERE NEAR THE LOAD CENTER

SAFE — ENOUGH TO INSTALL RIGHT IN THE WORKING AREA

Westinghouse DRY-TYPE Transformers are available in ratings of 15 kv and less; 500 kv-a single or three-phase. Illustration shows a 600-volt, 25 kv-a, Type AVR.

Westinghouse DRY-TYPE DISTRIBUTION TRANSFORMERS

Here's the smallest and lightest distribution transformer ever built . . . the new Westinghouse **DRY-TYPE** Transformer. It saves 36% of the copper and 50% of the steel previously required—and is a *better transformer.*

CONSERVES TIME . . . because no fireproof vault need be constructed. It is completely free from fire and explosion hazard.

CONSERVES POWER . . . because location at load center improves regulation, reduces length of heavy copper secondary cable runs.

CONSERVES MANPOWER . . . because maintenance is practically eliminated. There are no liquids to inspect, change or filter.

CONSERVES SPACE . . . because this drip-free unit can be mounted anywhere indoors—on a shelf, a post or overhead on a beam.

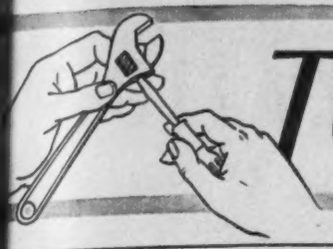
Three factors are responsible for this increased efficiency: (1) Class B Insulation (80°C. rise) which permits more kv-a output with less copper in the windings. (2) Hipersil*, the new Westinghouse electrical steel that has one-third more flux-carrying capacity. (3) "Know-how" of Westinghouse engineers in developing and using new materials. Your Westinghouse representative can give you complete details. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-70412

*Registered trade mark. Westinghouse Electric & Manufacturing Company, for HIgh PERmeability SILicon steel which carries ⅓ more flux.

Westinghouse DISTRIBUTION TRANSFORMERS

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

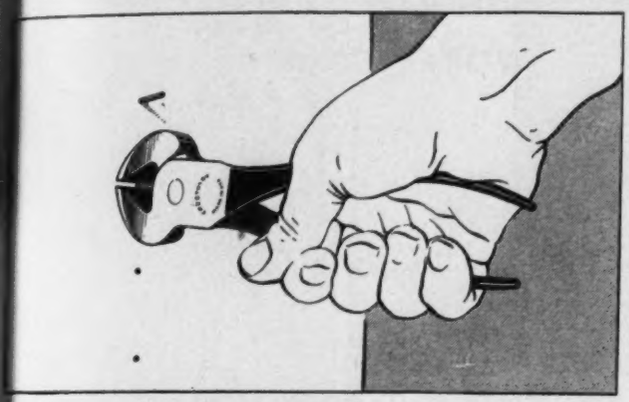


TOOL NOTES

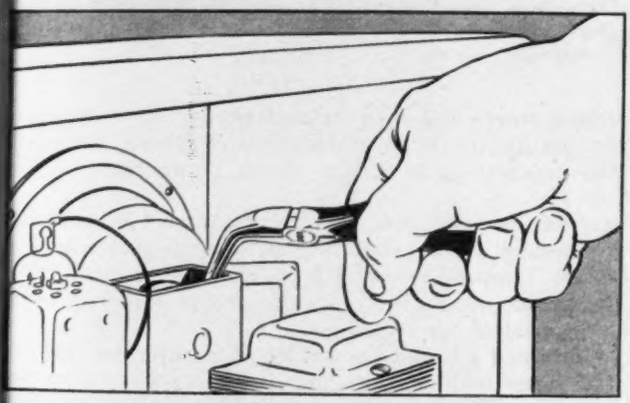
"How To Do It" Information For Crescent Tool Users

No. 14 . . . . PICKING THE PROPER TOOL FOR THE JOB

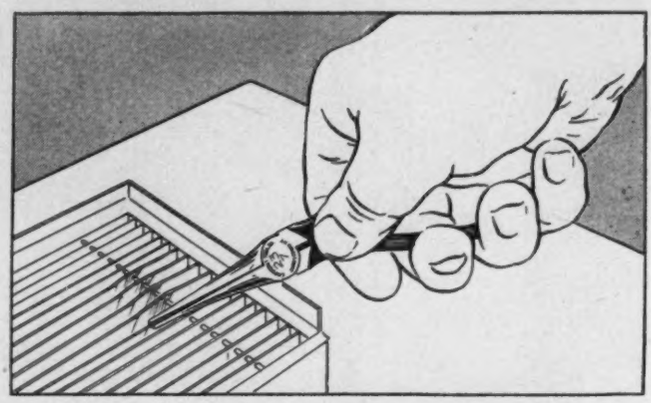
Next to knowing how to use tools, it is important to know which particular tool of a type to use for a given job or operation. With this in mind the next few issues of TOOL NOTES will cover this subject graphically.



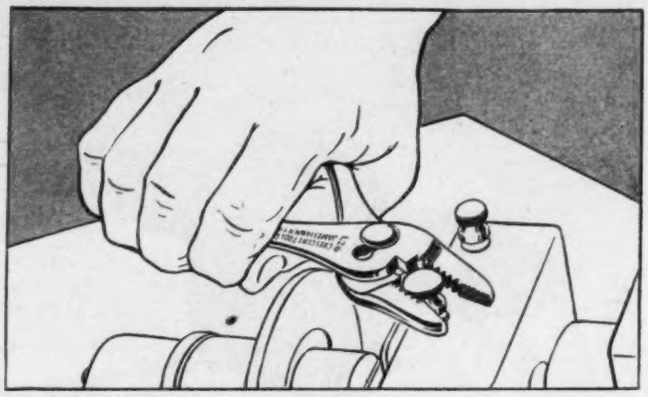
Where wire must be cut off close to a wall or other flat surface from which it protrudes, use CRESCENT END CUTTING NIPPERS. They make possible an almost flush cut because they are designed for that purpose. Example: cutting form wires on concrete work.



When you must work around obstructions or into tight, out of the way corners where fingers cannot reach, use CRESCENT CURVED NEEDLE NOSE PLIERS. They're designed to provide a good grip on small objects. Example: assembling and servicing radio sets.



The broad, flat, long jaws of CRESCENT'S DUCK BILL PLIERS not only provide excellent gripping power on flat surfaces, but will "reach in" and "work" where clearance is extremely limited. Example: straightening and spacing metal fins.



CRESCENT SLIP-JOINT PLIERS are a general-purpose tool, having excellent gripping power over a wide capacity range because of their adjustable jaws. Ideal for holding or turning round pieces. Example: loosening a "frozen" adjustment screw.

MAIL THE COUPON FOR FREE REPRINTS

This is No. 14, in Crescent's TOOL NOTES Series. These informative advertisements providing practical information for users of hand tools, are available either punched to fit a standard 3-ring binder or suitable for bulletin board and classroom use. Coupon request will receive prompt attention.

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

CRESCENT TOOLS
Give Wings to Work

Crescent Tool Co., Jamestown, N. Y. E-4

Please send your "TOOL NOTES" Series

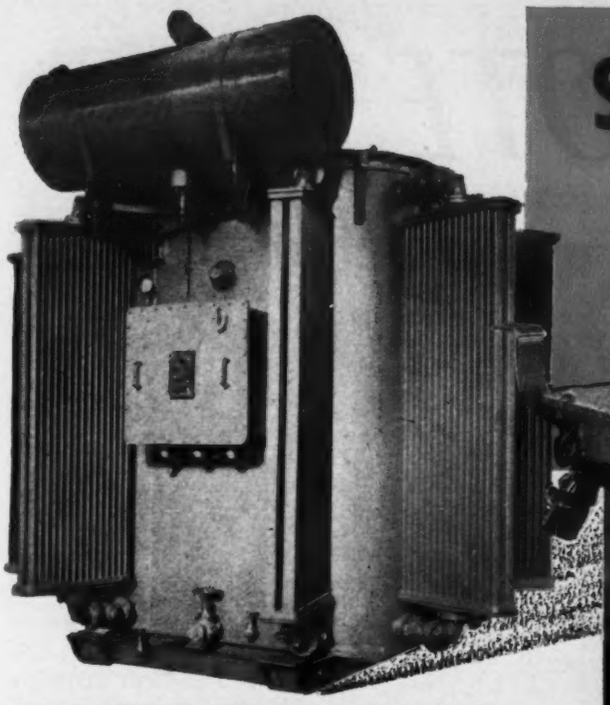
☐ for Bulletins ☐ for 3-ring binder

Name _____

Address _____

City _____ *State* _____

SPECIALIZATION
is the basis of
AMERTRAN Performance



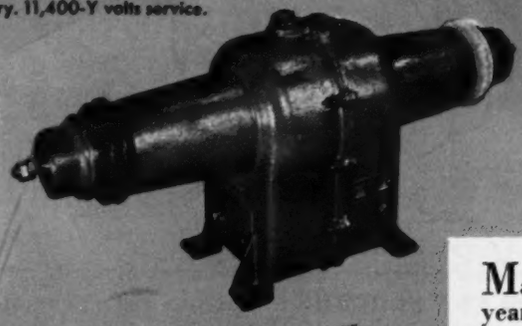
AmerTran Transformer. 5000 KVA, 3-phase, 60 cycles. 13,800 high voltage, 2400/4160Y low voltage.

AmerTran Transformer for pole mounting. 15 KVA. 2400/4160Y high voltage. 120/240 low voltage.

AmerTran Abestol Distribution Transformer. 150 KVA, single phase. 600 high voltage. 240/120 low voltage.

AmerTran Outdoor Current Transformer.

50 VA. 30 Amperes primary—5 Amperes secondary. 11,400-Y volts service.



Making *only* transformers and their related products for forty-two years has meant giving continued satisfaction—gaining increased knowledge in the process—and giving, again, in improved AmerTran products.

In these years of specialization, we have learned how to build AmerTran Transformers sturdy and long-lasting. The unusual life record of AmerTran Transformers has been effected simultaneously with a constant increase in efficiency, by the proper coordination of materials at the disposal of our engineers.

And we have obtained a broad knowledge of transformer applications as well. The outgrowth of that knowledge is a host of special AmerTran applications. The test sets, renowned for their precision—the voltage regulators with their smooth control through 100% range, if desired—and others.

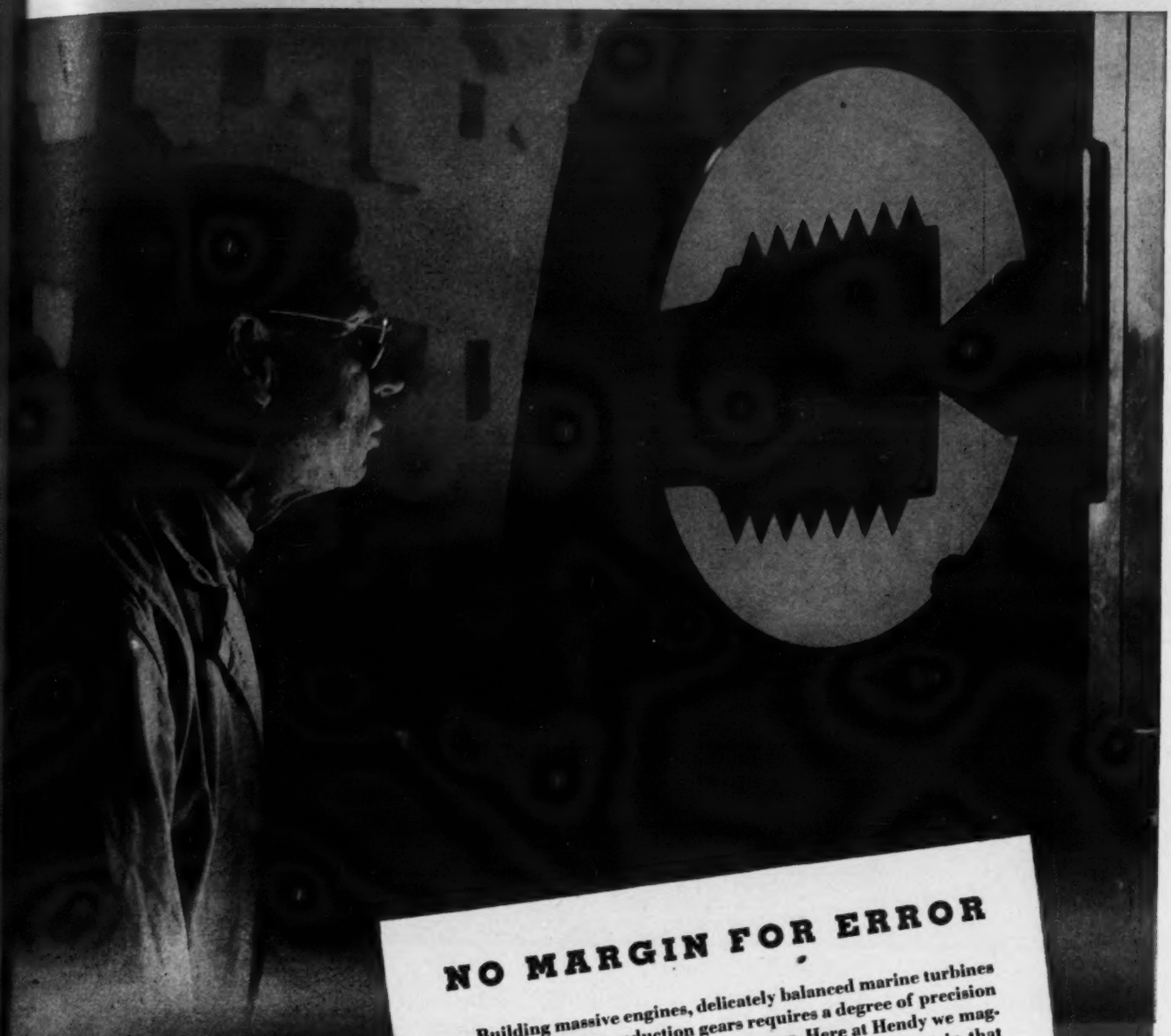
One of the great lessons of these years is that we fare best by maintaining AmerTran rigid standards of quality workmanship.

AMERICAN TRANSFORMER COMPANY
178 Emmet Street **Newark, N. J.**

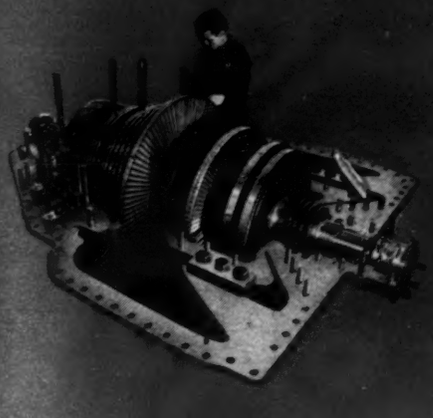
Pioneer manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission.

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.



Shown on the screen of this "Shadowgraph" is a broadcasting plug element, being checked for angle and load of thrust. Such gages are used to check the helicoids formed in marine turbines and reduction gears which are now being produced by Hendy.



NO MARGIN FOR ERROR

Building massive engines, delicately balanced marine turbines and quiet running reduction gears requires a degree of precision and skill that leaves *no margin for error*. Here at Hendy we magnify small details to gigantic proportions, to make certain that Hendy powered ships reach their destinations with no preventable engine failure.

That's why skilled craftsmen check the measurements of intricate parts with super-accurate gages and, in turn, these gages are checked to five ten-thousandths of an inch in a temperature controlled gage inspection room.

Combining high standards of precision with mass production methods Hendy provides the Pacific Coast with an organization competent to build a wide variety of massive units in volume... for war now... for peace later on.

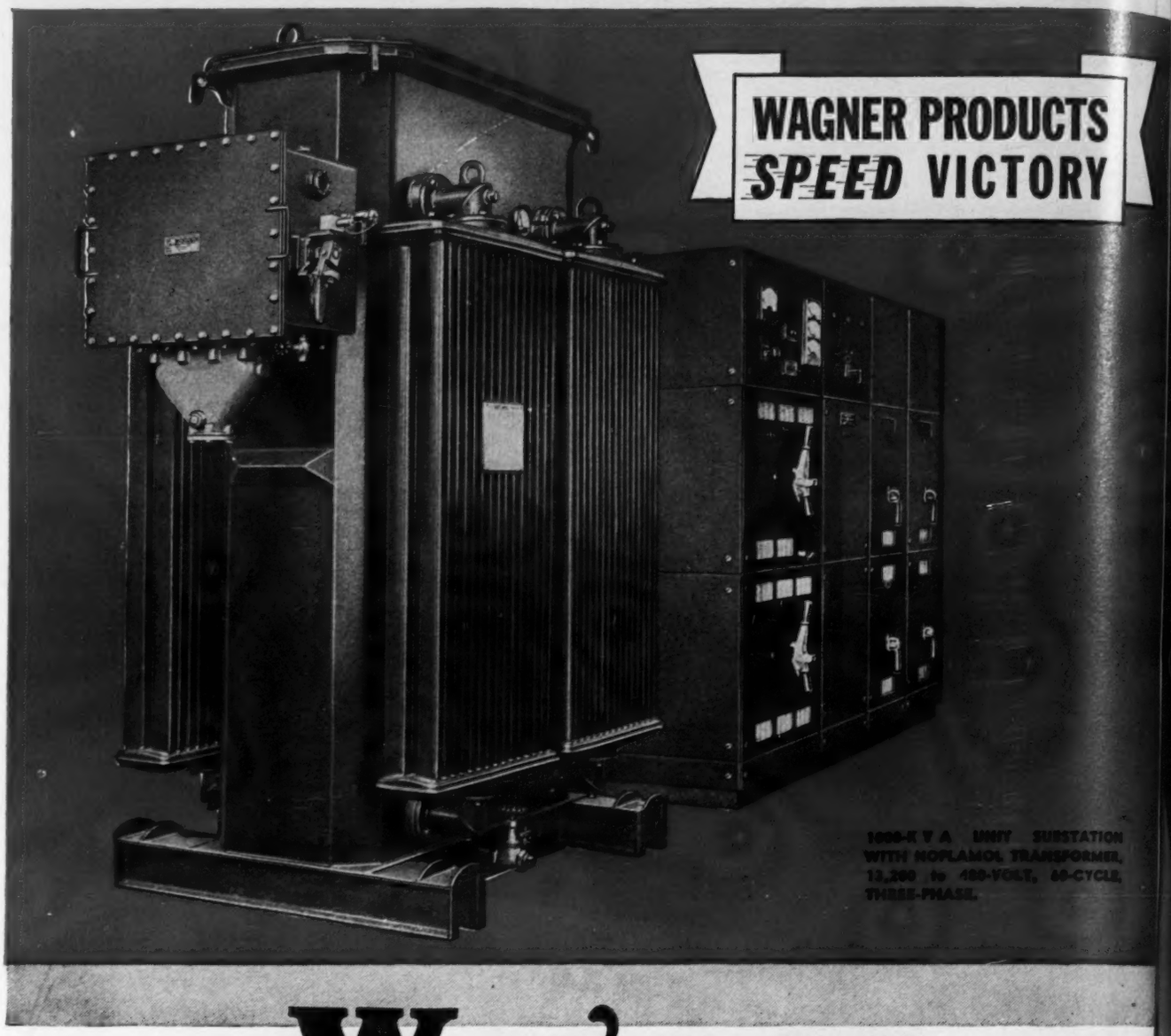
JOSHUA HENDY IRON WORKS

ESTABLISHED 1856

SUNNYVALE • CALIFORNIA

Divisions: POMONA PUMP COMPANY
CROCKER-WHEELER ELECTRIC MFG. CO.

Manufacturing Plants: SUNNYVALE, LONG BEACH, POMONA and ELSEMERE in CALIFORNIA • AMPERE, N. J. • ST. LOUIS, MO.
Branch Offices: NEW YORK • WASHINGTON • PHILADELPHIA PITTSBURGH • CHICAGO • ST. LOUIS • SAN FRANCISCO • LOS ANGELES



1000-K V A UNIT SUBSTATION WITH NOFLAMOL TRANSFORMER, 13,200 to 480-VOLT, 60-CYCLE, THREE-PHASE.

Wagner

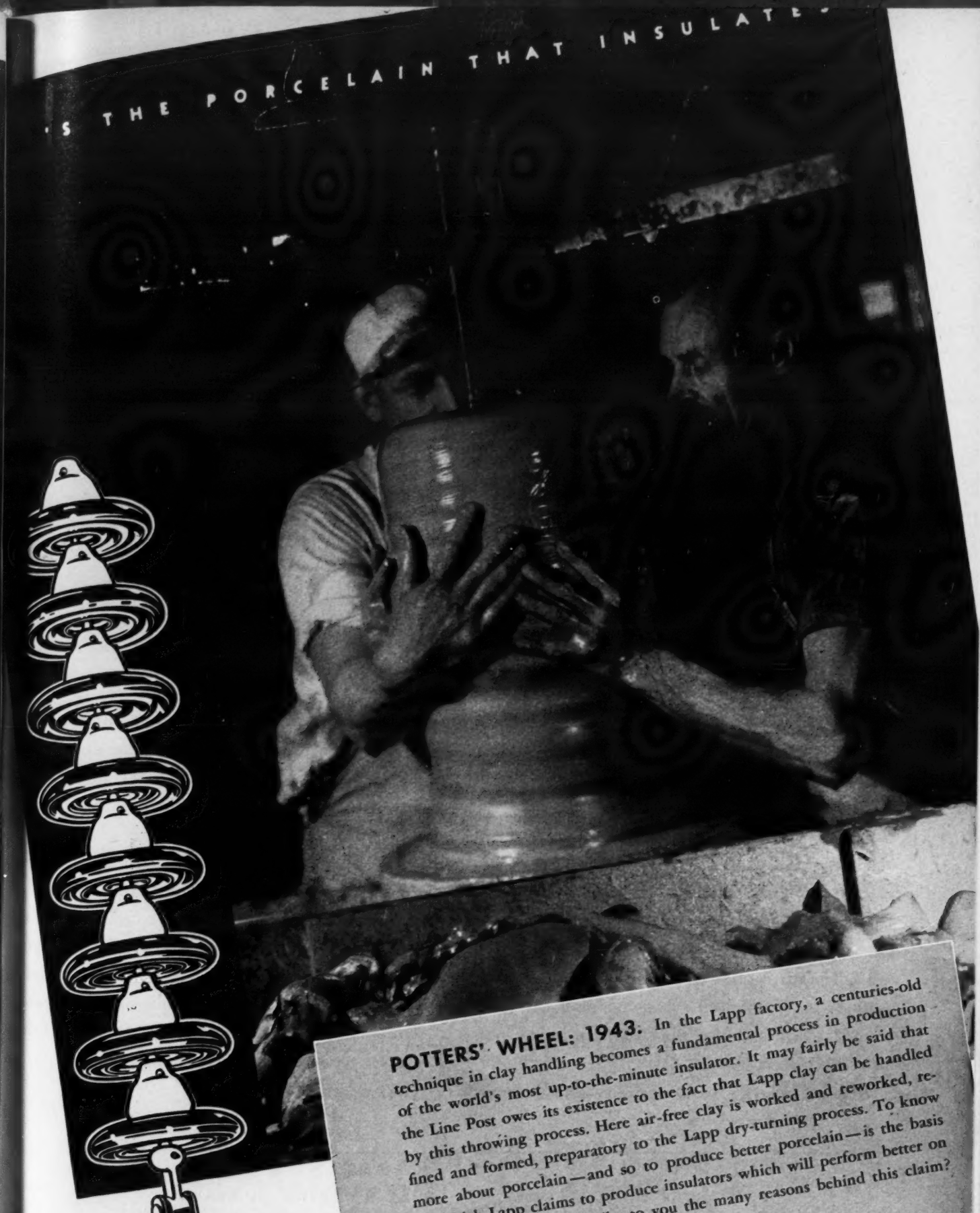
UNIT SUBSTATIONS

are doing their part in the production of steel, synthetic rubber, oil, and other vital materials

The Unit illustrated above is installed in a synthetic rubber plant. The transformer has a two-position liquid-filled disconnecting switch on the high-voltage side which is equipped with low-voltage interlock. The low-voltage side is equipped with air-break circuit-breakers electrically or manually operated, ground indication lights, voltmeters, ammeters, and ammeter test blocks. Unit has one main breaker, one tie transfer breaker, and four feeder breakers.

For Complete Information on Wagner Unit Substations write or phone the nearest Wagner branch office.

Wagner Electric Corporation
ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis, 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS



POTTERS' WHEEL: 1943. In the Lapp factory, a centuries-old technique in clay handling becomes a fundamental process in production of the world's most up-to-the-minute insulator. It may fairly be said that the Line Post owes its existence to the fact that Lapp clay can be handled by this throwing process. Here air-free clay is worked and reworked, refined and formed, preparatory to the Lapp dry-turning process. To know more about porcelain—and so to produce better porcelain—is the basis on which Lapp claims to produce insulators which will perform better on your lines. May we describe to you the many reasons behind this claim? Lapp Insulator Co., LeRoy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulators

Because of its greater stability —

Gulf Parvis Oil

insures long Diesel life and operating economy

"OUR two oldest Diesels have operated efficiently for twenty years with Gulf Parvis Oil in service," says a municipal power plant Superintendent. "During this period only one repair has been necessary—a liner change. These engines still run sixteen hours a day and deliver their full share of plant output."

Here's the important reason for the fine service records of Diesels lubricated with Gulf Parvis Oil: This higher quality oil *retains its lubricating value longer*—it stands up and provides a tough protective film that keeps moving parts properly lubricated.

Because of its greater stability and the extra margin of protection it affords, Gulf Parvis Oi insures minimum wear, minimum down time and efficient, dependable Diesel performanc under today's peak-load and overload operat ing conditions.

For effective help in *your* fight against wear take this step today: Call in a Gulf Lubricatio Service Engineer and ask him to recommend th proper grade of Gulf Parvis Oil to fit you particular requirements. His thorough training and broad practical experience with all types o Diesel engines are your assurance of sound lubri cation recommendations. Write, wire, or phon your nearest Gulf office.

GULF OIL CORPORATION · GULF REFINING COMPANY

GULF BUILDING · PITTSBURGH, PA.

GULF INDUSTRIAL LUBRICATION

NEW ABUNDANT REPLACEMENT FOR CRITICAL MATERIALS

PRESTITE—*the new pressure-molded ceramic*—IS WORKABLE!

Easy workability makes PRESTITE a "natural" as a replacement material for many applications. Where metals or other materials often present problems in machining, PRESTITE pieces can be turned and shaped on a wheel or lathe, before firing, as easily as clay. Final dimensions can be held to very close tolerances; grinding after firing makes possible extreme precision fits.

Workability is just one of many properties hastening PRESTITE'S adoption as a permanent replacement for many materials now critical: PRESTITE is impervious to moisture and chemicals except hydrofluoric acid . . . can be cored for intricate internal cavities . . . and can be mass-produced. PRESTITE also can be manufactured with several bodies to yield various characteristics such as for applications requiring resistance to unusually high heat shock.

When desired, the modulus of rupture also can be varied from 2.5 to 4.2 and its electrical loss factor reduced far enough so that it may be used as an insulator at ultra-high radio frequencies.

PRESTITE is replacing other materials in an increasing variety of products including sand-blast nozzles, high-speed pump valve seats, brackets and many others.

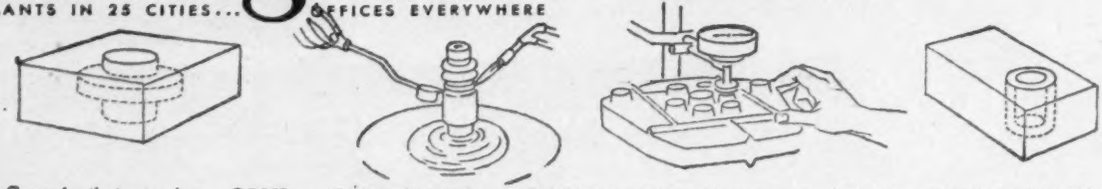
If the qualities and applications of PRESTITE briefly sketched here suggest a clue to your product-problem, Westinghouse will be glad to work with you in solving it.

★ ★ ★

GET THE FACTS ABOUT PRESTITE. New PRESTITE Book shows applications in many fields . . . presents technical working data for designers . . . design suggestions and limitations . . . charts and test results. Write for B-3121. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-05140

Westinghouse PRESTITE

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

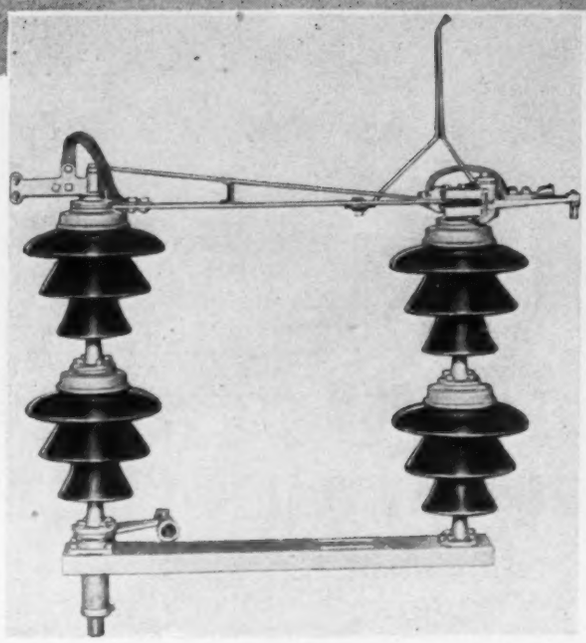


...e New Pressure-molded Ceramic that can be... CORED... JOINED TO METAL... MOLDED to close tolerances... designed with METAL INSERTS

THE ALL PURPOSE HIGH VOLTAGE Switch

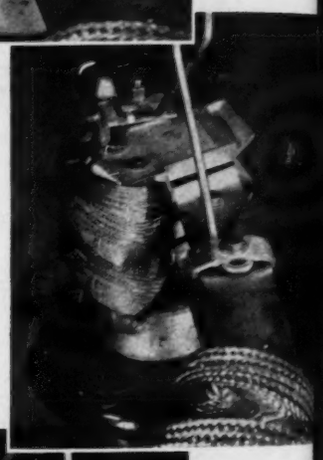
Type 6600

for today's conditions

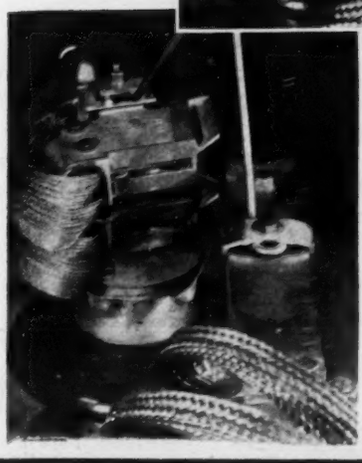


Progressive Movement of the blade

★ The blade fully closed



★ Starting to open, showing the pivoting action of the sleet hood



★ The blade fully removed from the sleet hood and contact shoes

This type switch serves efficiently as

A Substation Switch
A Line Sectionalizing Switch
An Oil Circuit Breaker Disconnect
A By-Pass Switch

It uses the minimum amounts of critical materials and occupies the smallest space on the mounting structure.

Only two insulators per pole, one rotating and one stationary. It's simplicity in itself.

Its full-floating pivoted contacts permit of easy operation under all conditions. (See progressive blade movement illustration at right.)

Get acquainted with this high quality switch. Built for all voltages 7.5 to 161 kilovolts.

Send for Bulletin #325.

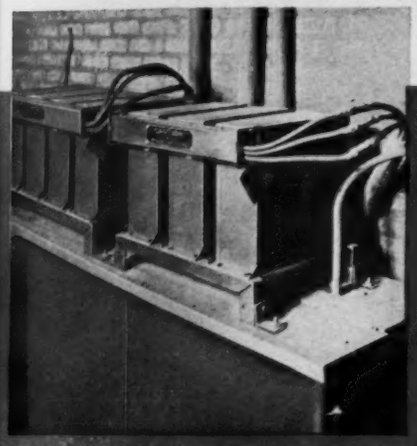
THREE ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

CAPACITORS

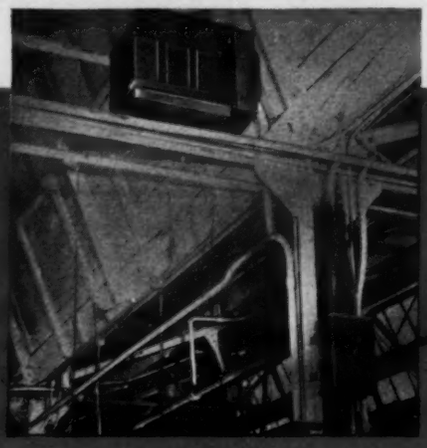
are not cure-alls

but they WILL . . . Raise System Voltage Level . . . Increase Current Capacity . . . Reduce Overheating

Though we are partial to capacitors, naturally, for we make more of them than any other manufacturer in the world, we fully appreciate that capacitors are not the answer to your every electrical problem. But we know that capacitors have their place — and it's a mighty important one. For example, take these reports on typical C-D Capacitor installations for power-factor improvement.



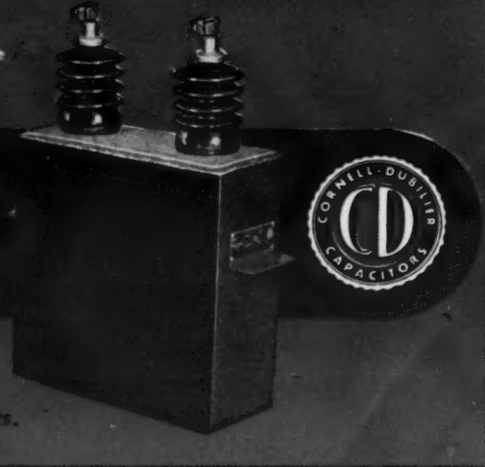
C-D Capacitors Raise the System Voltage Level. At a large industrial plant low power-factor was the cause of considerable voltage drop in the feeders. By installing C-D Capacitors, this company was able to raise the voltage level and secure better voltage regulation—greatly increasing operating efficiency throughout the plant.



C-D Capacitors Increase Current Capacity. A mid-western manufacturer added over 200 motors to keep pace with the wartime demand for his product. By installing C-D Capacitors, the operating current was reduced from 1,040 to 675 amperes — and no additional copper or generating equipment was necessary.

C-D Capacitors Minimize Overheating. The overloaded feeders, motors and switchboards of a machinery manufacturer were running hot and blowing main fuses several times a week. After Cornell-Dubilier Capacitors were installed, overheating was materially reduced and since then, no fuses have been blown.

Many industrial plants and utility systems have solved the problem of wartime power demands by installing C-D Capacitors. Long after the emergency has passed, their Cornell-Dubilier Capacitor installation will continue to work for them 24 hours a day. Our engineers will be glad to survey your system and estimate the advantages of a C-D Capacitor installation as applied to your specific requirements. CORNELL-DUBILIER ELECTRIC CORPORATION, South Plainfield, New Jersey.

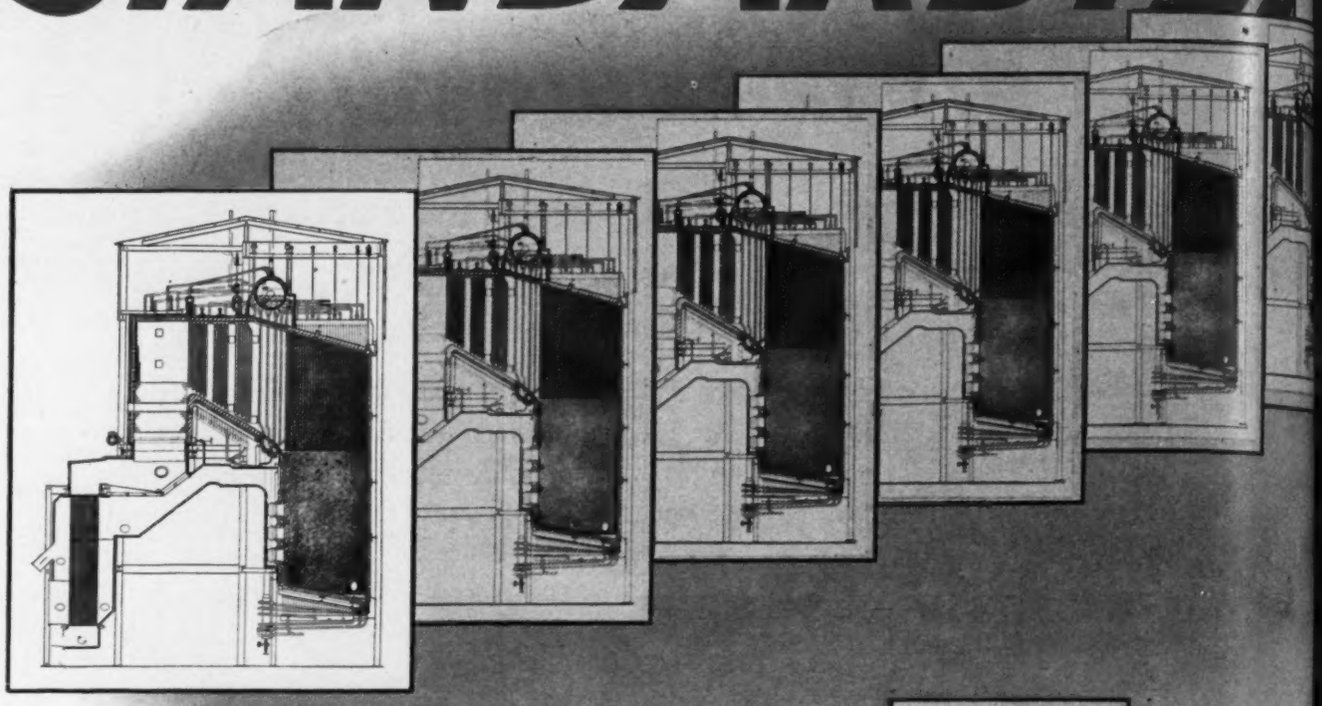


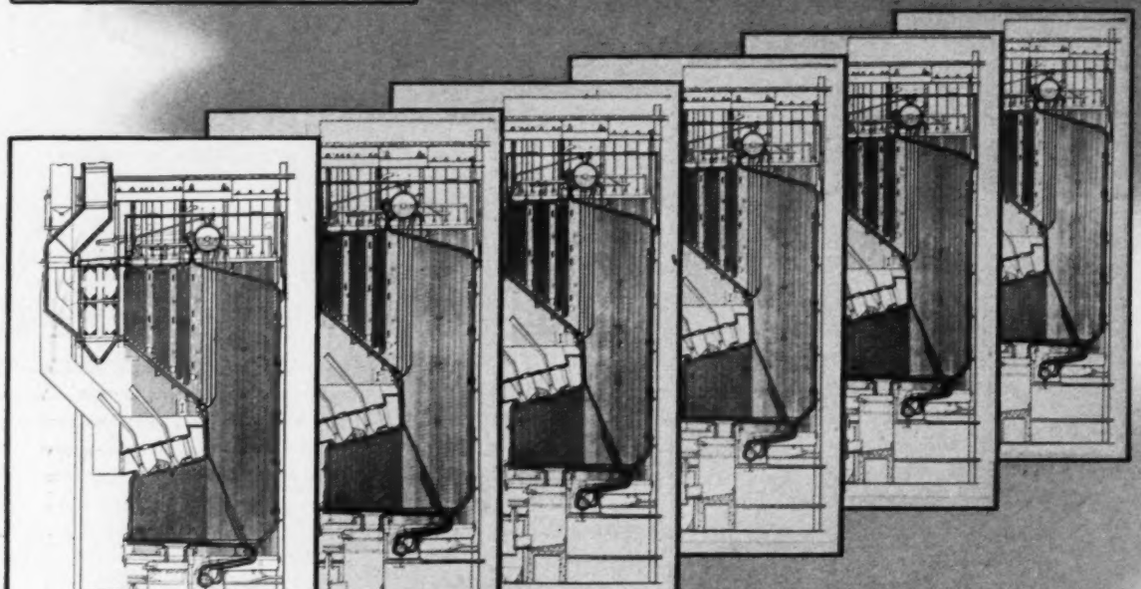
Cornell-Dubilier Capacitors

FOR POWER-FACTOR IMPROVEMENT

Available on short notice — quickly and easily installed — can be arranged to permit easy switching of corrective capacity to meet changing load requirements.

STANDARDIZ





Another compa
has six B&W
diant Boilers of
same design in
plants—four in o
and two in the oth
Capacity e
boiler, 550,000
steam per ho
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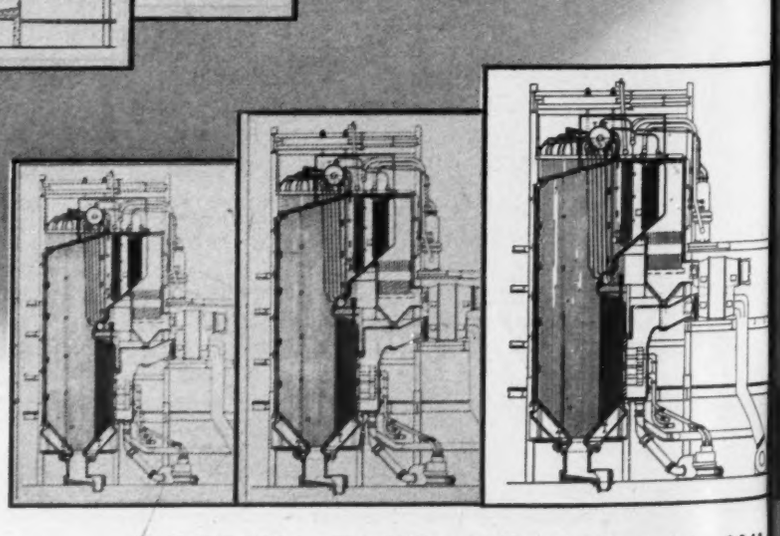
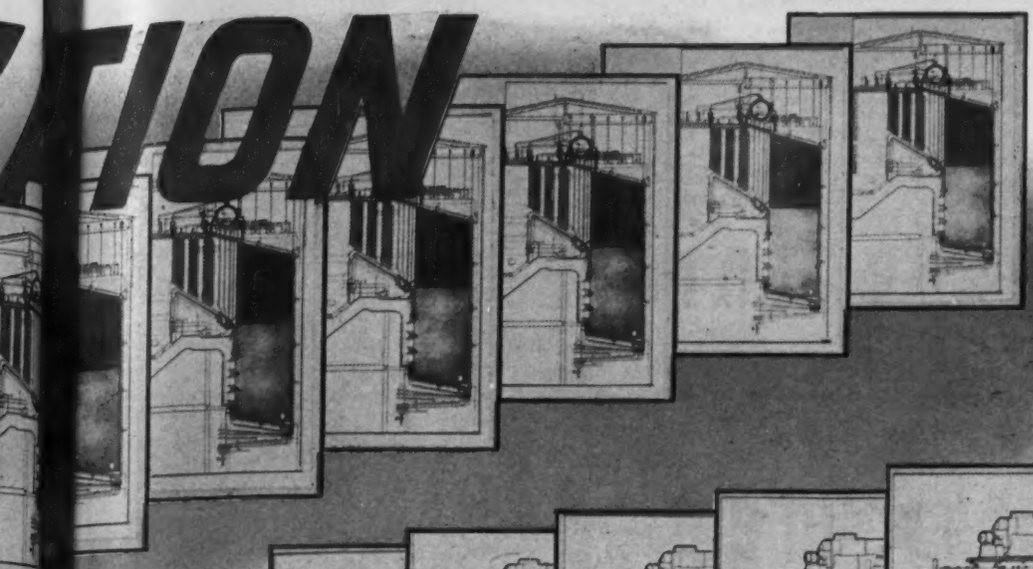
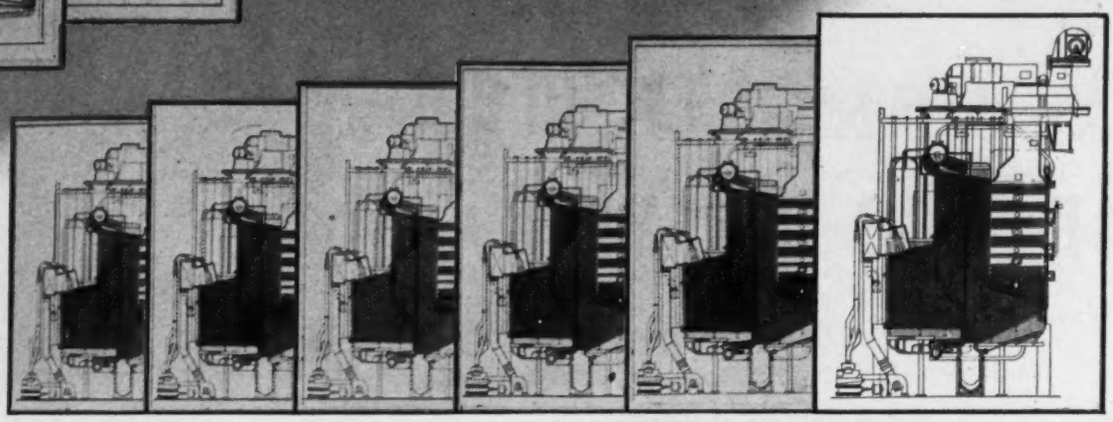
fired.



Another company has two B&W Radiant Boilers in one station and one in another station. Capacity each boiler, 550,000 lb. steam per hour. Pulverized-coal fired.



Twelve B&W Radiant Boilers of the same design are in service in three stations of the same company — six in one station, three in another, and three in the third. The boilers are multi-fuel fired and generate 200,000 lb. steam per hour each.



...ther company ... four B&W ...n-Pass Boilers ...ne station and ... in another ...ion. Capacity ...h boiler, 450,- ... lb. steam per ...r. Pulverized- ... fired.

...for Better Values

Standardization suggests today the duplication of many things, particularly the production to the same specifications of war-time equipment in economical quantities. The system is not new—only the scale is new, and amazing. An outstanding example is its application to the construction of the great fleets of naval and cargo ships and of the boilers for these ships—for the production of which B&W has been awarded the Army-Navy "E" and Maritime Commission "M".

Standardization is possible in the case of these marine boilers, because, although there are a number of designs of ships and boilers, ships of the same class are being built in large numbers, and generally, they have propulsion equipment of the same design, have similar boiler space, feedwater, and fuel conditions, and are suitable for boilers of the same size, design, and steam characteristics.

In the stationary field, where the number of boiler units that can be built in multiples is smaller in most cases, where space conditions differ in different plants, and where steam capacity and characteristics, feedwater, and fuels are all factors of varying relationship to each other, it is understandable why no single design of power boiler has to date been adopted as a standard. However, as indicated by the illustrations, certain designs of complete B&W Boiler Units have been installed on an exact multiplication basis. By this means, engineering costs were reduced, fabrication and installation time shortened, and other equally obvious advantages obtained.

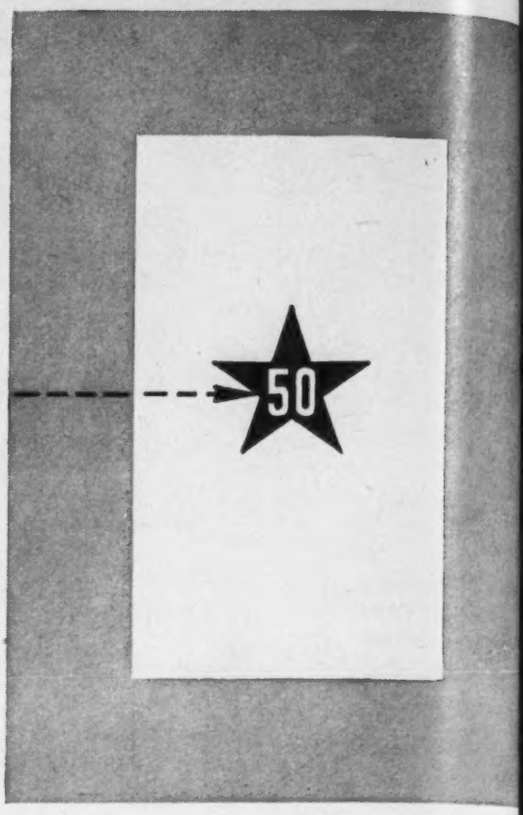
Such standardization does not necessarily result in freezing of designs, or details of designs. Progress in the art, resulting from continuing experience in operation and in the development of materials and manufacturing processes, will assure the continued application of equipment that meets fundamental engineering problems arising from changing economic conditions and operating requirements. To this end, B&W will, as it has in the past, continue its research and development, in order to create new standards that will result in better values to purchasers of its equipment.

BACK THE ATTACK— BUY MORE WAR BONDS!

THE BABCOCK & WILCOX COMPANY, 85 LIBERTY STREET, NEW YORK 6, N. Y.

BABCOCK & WILCOX

an open letter to WIREMOLD men in the service...



Hartford, Connecticut

I cannot tell you how much personal satisfaction it gives me to report to you that your Company has been awarded the Army-Navy E for excellence in the production of the materials you need to fight with.

The men and women you worked with have earned this award by putting every ounce of their energy, and then some, into their particular jobs. Our part is a small one compared to the one all of you are playing, but in this man's war, every wheel must turn constantly and fast.

We can honestly say that one of the most important factors in spurring us on to the kind of effort we have achieved is our thoughts of those of you who have left to go into the armed forces. The work that has brought this Award is about the only way we have of telling you that we're in the outfield backing you up. You have our pledge that we will continue to do so.

Best of luck from all of us.

THE WIREMOLD COMPANY

D. Hayes Murphy
President

P.S. We are continually increasing our purchase of War Bonds, too.

WIREMOLD Makers of Textile Webbing and Metal Precision Parts for the Army and Na

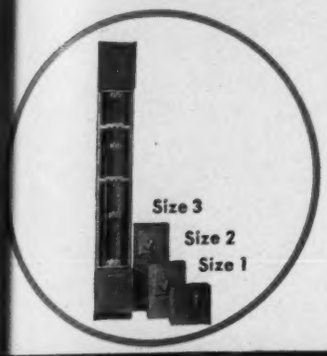
TRUMBULL-PIONEERED

"packaged" POWER CONTROL

(PREFABRICATED SWITCHBOARDS)

AKES CONTROL CENTER INSTALLATION

Simple as a b c

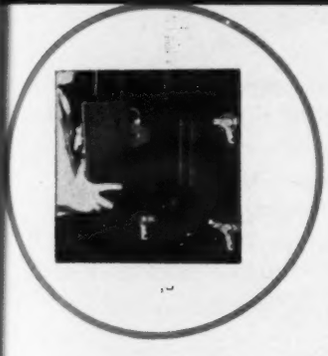


a ORDER STANDARDIZED STOCK SECTIONS AND UNITS . . .

SAVES TIME . . . It used to take plenty of careful engineering and weeks of installation time to lay out power wiring and control equipment for a factory . . . until Trumbull pioneered application of the CONTROL CENTER idea. Now the engineering has already been done, and done well . . . on our time, not yours. You buy "packaged" units right out of stock. They are assembled, with almost "building block" simplicity, to give exactly the right combination of centralized switchboard or motor control equipment for your job . . . ready for power weeks or months sooner than possible under old-time schedules.

b ASSEMBLE & GROUP SECTIONS TO FIT YOUR NEEDS . . .

SAVES MATERIALS AND SPACE . . . Centralized Trumbull Control Center installations simplify feeder and machine wiring layout...use far less critical materials for a given load capacity, prevent waste in conduit and cable use. In large plants, control centers can be located centrally in production areas, BACK TO BACK OR AGAINST WALLS . . . requiring minimum space, all units, parts, and wiring connections ACCESSIBLE FROM FRONT . . . exclusive Trumbull features.



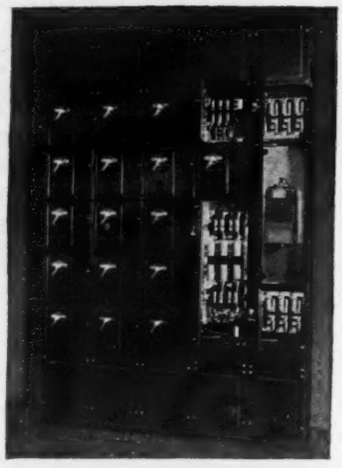
c PLUG IN REQUIRED CONTROL UNITS FROM FRONT

ASSURES FUTURE FLEXIBILITY . . . Vertical sections and interchangeable PLUG-IN TYPE control units provide flexibility never before possible . . . yet an exceedingly important factor in every plant today. Major revamping of an entire plant set up becomes possible by merely adding, subtracting or regrouping units and sections without any of the costly tie ups such work would ordinarily entail. Control Center installations made today provide the flexibility essential to war production and to later post-war reconversion.

This page merely covers the highlights. New Trumbullaid Bulletin No. 411 gives all the facts. Write for your copy today.

TRUMBULL

CONTROL CENTERS



THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

PLAN YOUR DISTRIBUTION SYSTEM

FOR *Quick Conversion*

Future demands on your plant depend on events no man can accurately foretell. Sound practice today calls for farsighted planning—to insure the ability to make quick production shifts economically.

Such shifts depend to a large extent on your plant distribution system. For on it hinges the ability to meet quickly changes in the nature, location and density of loads.

That's why we say *plan now for maximum flexibility in your plant distribution system*—to give increased efficiency and sabotage protection today, to facilitate speedy and economical conversion tomorrow.

Westinghouse has designed and built hundreds of distribution systems for all types of plants. Thus our engineers are in a position to recommend the "one best" distribution system for your plant—the system that provides maximum flexibility with the least use of critical materials.

To bring this broad engineering experience to bear on your particular problem, call our local office. Or send for the helpful booklet below. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pennsylvania. J-94562

UP-TO-DATE FACTS ABOUT DISTRIBUTION SYSTEMS

Keep up-to-date on latest plant distribution systems. Send for 24-page Booklet, B-3152, which briefly describes different plant distribution systems, and points out the advantages of each.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

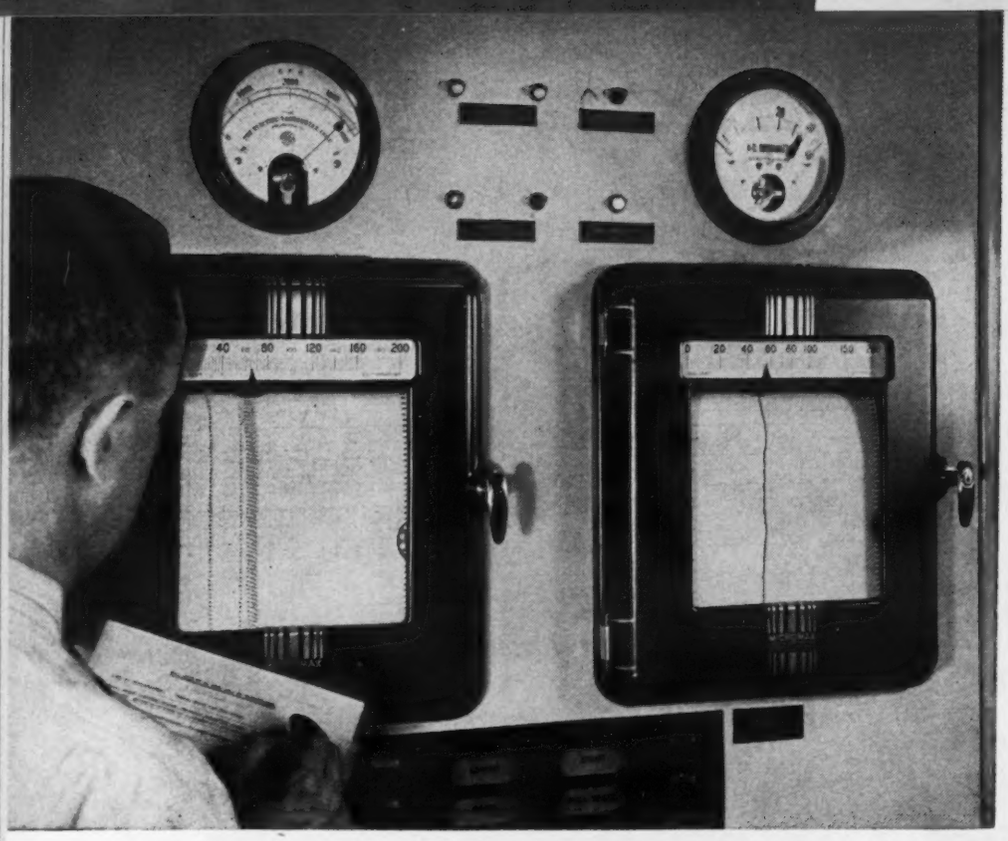
PLANT DISTRIBUTION SYSTEMS

Proud as a peacock, bustin' with pride and satisfaction—a new DAD!

We like to think you have a good feeling of satisfaction, too, over your domestic heating load. The durability of the Chromel elements, now so hard to get as replacements, keeps the heating devices still plugged into your lines, as good and steady revenue producers. For technical data on Chromel ask for Catalog M-W.

HOSKINS MANUFACTURING COMPANY, DETROIT, MICHIGAN

Chromel
NICKEL CHROMIUM
HOSKINS
CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE



Micromax Recorder at left shows temperature of 6 points in stator, and also of exciter air and outlet water of the hydrogen cooler of a generator in Ohio. Recorder at right shows temperature of the field. Watching these 9 temperatures is essential when carrying heavy load, though Recorders will also sound alarms if any one temperature exceeds a predetermined point.

OVERLOAD PILING UP?

Fields and Stators are Safer When a Micromax Recorder Watches Each

Loading of electrical generators on the basis of the temperatures of their stators and rotors is a practice which is now gaining ground, especially where load is so heavy that individual machines must carry even more than their usual percentage of nameplate-rated loads. Many power companies are now running special tests to determine the amounts of load which may be added, under specific conditions, to that given as maximum on the nameplate. Here are some of the factors to be considered:*

1. Each generator is a separate problem.
2. Nameplate data may provide unnecessarily large safety factor for load swings, unbalanced phases, etc.
3. Ambient temperature may be less than nameplate specifies.
4. Power factor may be higher than specified.
5. Change in terminal voltage may permit greater output.
6. When starting from low temperature, a generator can carry short-time excess load because of its own temperature lag.
7. In emergencies and for short peaks it may be more economical to operate at extraordinary temperature and thus age the insulation at an abnormal rate, rather than to provide the additional rated capacity for short-time loads.

When a generator is loaded on the basis of temperature, we can supply its operator with complete temperature readings by means of two instruments—a Micromax Stator Temperature Recorder and its companion, a Rotor Recorder.

The Stator Recorder shows the temperature of 6 points, and of incoming and outgoing cooling medium. It sounds an alarm if a peak temperature is reached.

The Rotor-Temperature Recorder measures the resistance of the entire field and records it as temperature. Devised about 15 years ago, it has been less used than the Stator Recorder, for the reason that not every generator normally needs both instruments. As load becomes abnormal, or unfavorable power factor conditions occur, however, it is often wise to measure the field temperature directly.

Further information in Catalog N-33-161.

* Abstracted from a small portion of AIEE Miscellaneous Paper 43-93, "Interim Report on Emergency Measures to Increase Output of Generating Equipment and Systems," June 1943, available at 65¢ from AIEE, 33 W. 39th St., New York City.

Jrl Ad N-33-161(4)

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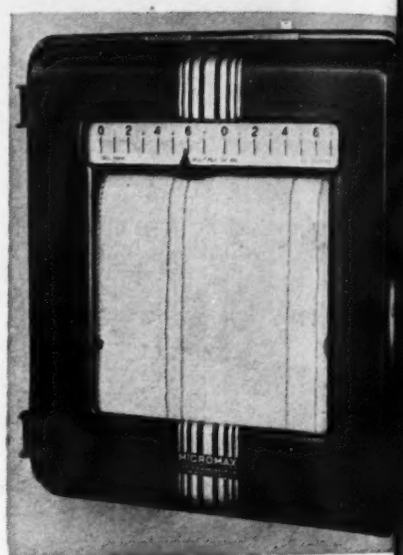

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When you want clearly to separate two temperatures recorded by one instrument, and they are almost identical, you can keep them from recording on top of each other by using a Split-Chart Micromax Recorder, shown above. All temperatures of one boiler go on left-hand; all of other boiler go on right-hand; thus there's no confusion. Designed especially for power-plants, with daily tear-off and multicolor record if desired. Further facts either from an L&N Engineer or from Folder N-163(2), as you prefer.

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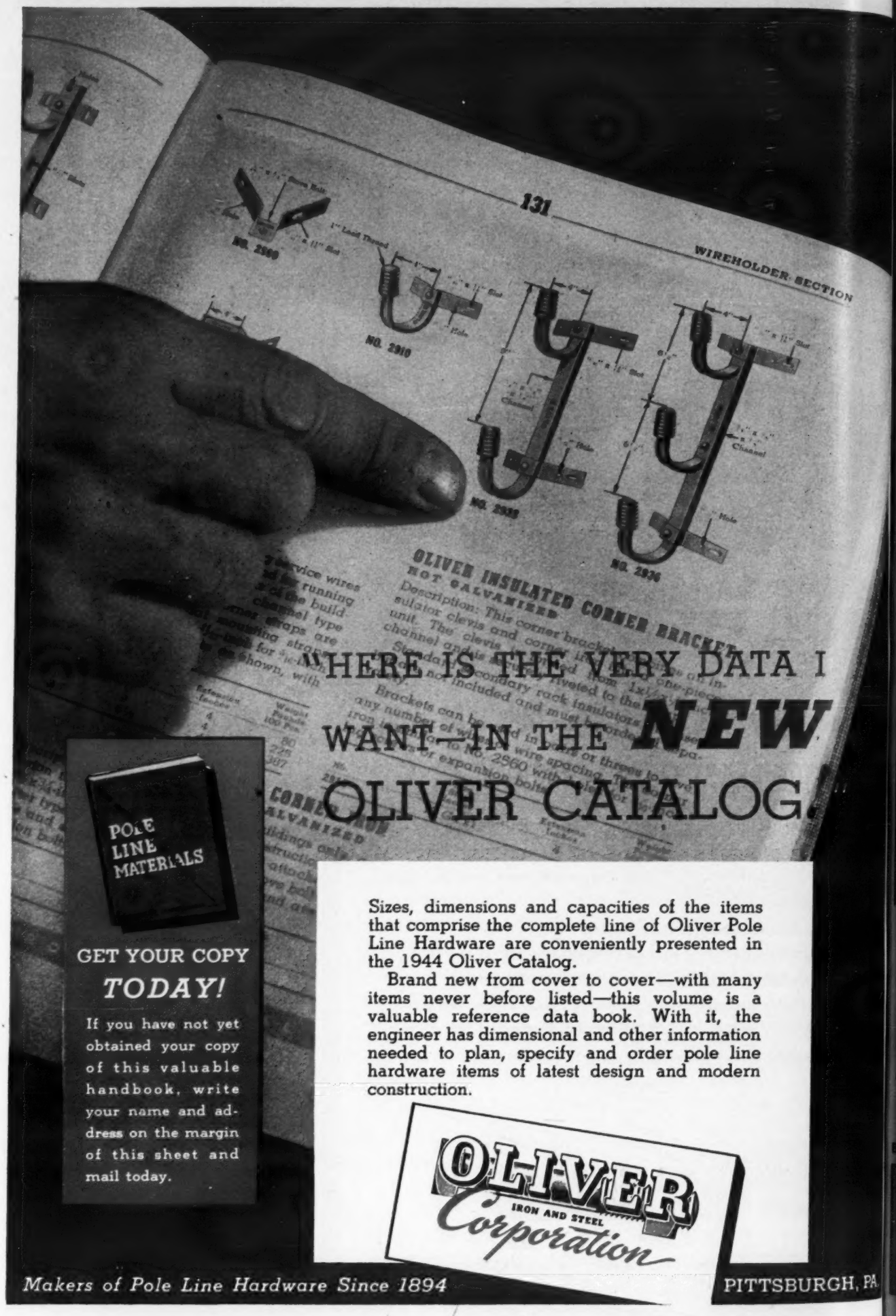
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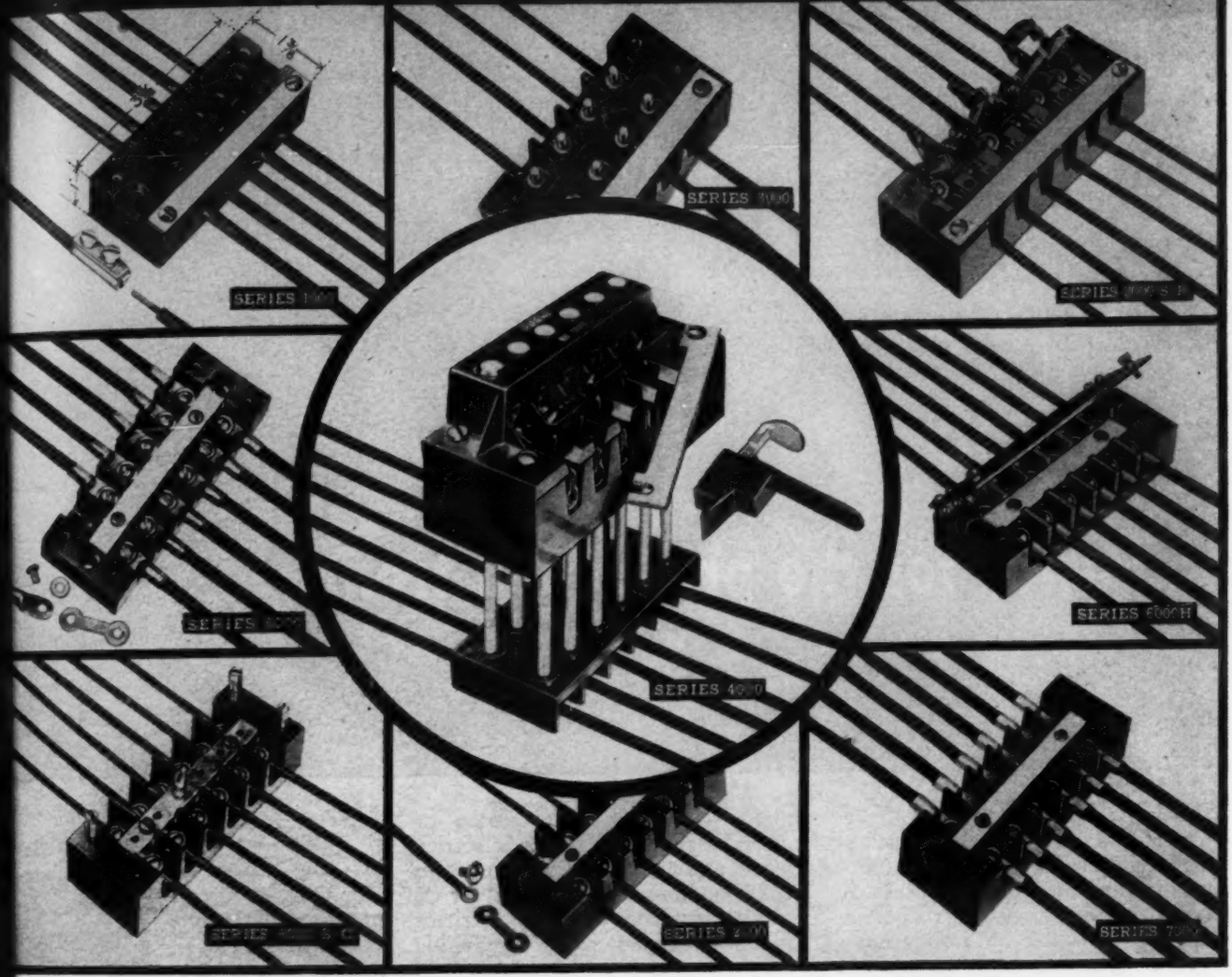

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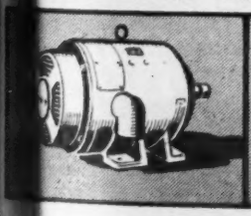

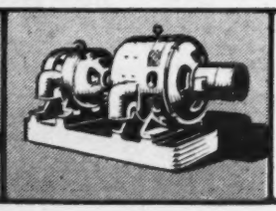

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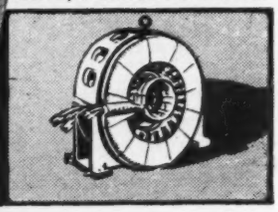


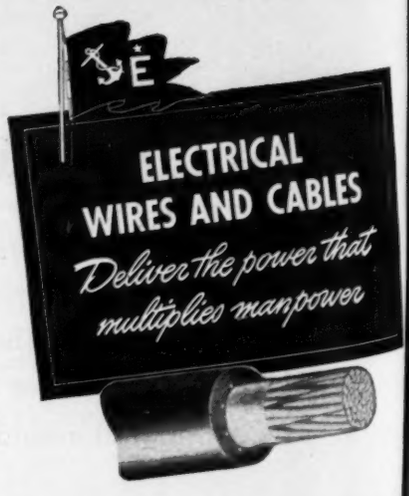
Power for the production front!

WELDING has probably contributed more to the improvement and speeding up of war production than any other single process. It saves time and money. It is a potent production weapon that women have learned to use as skillfully as men.

Here, again, electricity plays a vital role. Unfailing electric power must feed these modern tools. And unfailing power requires unfailing transmission and distribution—a job that can be entrusted only to electrical wires and cables of the finest quality.

For years, American Steel & Wire Company engineers and production experts have experimented with new methods and new materials to improve the quality of our electrical wires and cables. The war proved the soundness of this policy, for the sudden scarcity of certain critical materials did not catch us napping. New materials were available to help the conservation program without sacrifice of quality or performance. Our products were ready when the emergency came; and they'll be ready when peace comes.

For our research goes steadily on—working on new ideas and developments to take care of the increased wartime demand for power and light and the ultimate conversion to peacetime requirements.



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UNITED STATES STEEL

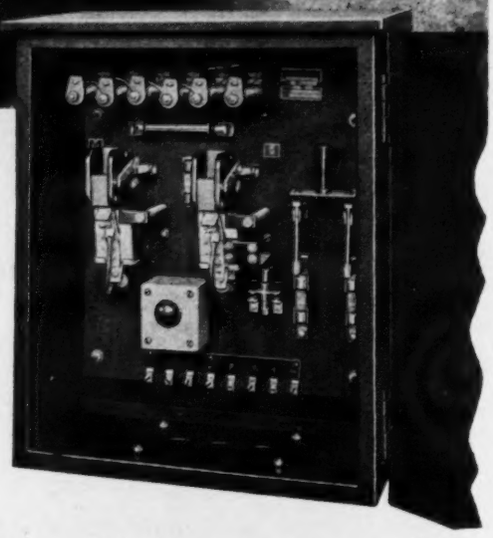
EC&M Spring-Loaded Magnetic Contactors "met the situation"

Official U. S. Navy photograph

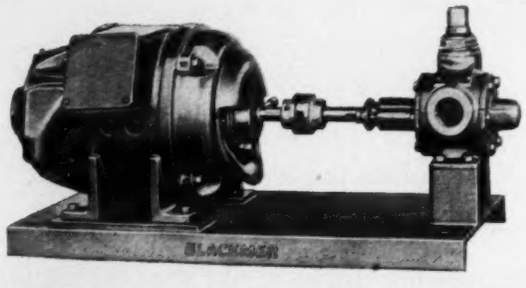
THE Government needed magnetic starters for auxiliary pumps on mine-sweepers—starters to withstand the rolling and pitching of these small craft on heavy seas—starters so designed that accidental closing could not happen under these conditions.

EC&M had a commercially proven, spring-loaded contactor of proper size—one which was held in the "open position" by a spring. The need was urgent—EC&M quickly designed starters to "meet the situation."

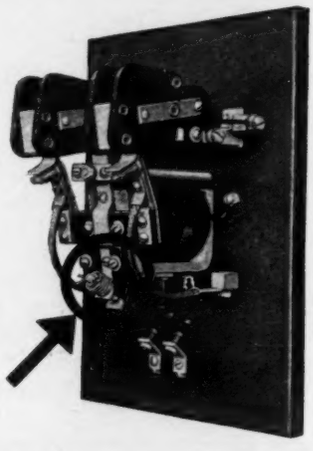
On many phases of the war effort, EC&M Contactor Control is giving a splendid account of itself on vital projects of extreme interest. Some day, perhaps, the story can be told.



Typical EC&M D-c Starter with single-pole, spring-loaded contactors, front-connected resistors and drip-proof cabinet.



Blackmer pump unit of the type used for naval auxiliaries.



Showing location of spring on EC&M 50-ampere Contactor of double-pole design.

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When Will "The Age Of Electronics" Begin?

THE answer, obviously, is when the war is *won,* for only then can America's scientists and engineers—now concentrating on electronics for war—devote all of their efforts to applying electronics to peacetime uses. But because it's their nature to *prepare* for the unpredictable future, many of them, despite heavy working schedules, are already thinking about post-war products utilizing their electronic discoveries.

If you are one of these men, working on wartime or post-war problems, we'd like to suggest that you consider incorporating the principle of the *permanent magnet,* and that you ask us for any information you need. Because we've specialized in this *one* field for 33 years, we've been able to design and produce permanent magnets that have improved the functions and increased the uses of many vital electronic devices, as well as countless other important products. To these we made a valuable engineering contribution. To *you* we offer the same service.

Though our plant (the nation's largest specializing in the making of permanent magnets) is devoted to war orders, our engineers will be glad to consult with you and give your problems the benefit of their unusual experience.

Write for the address of our office nearest you and a copy of our 30-page "Permanent Magnet Manual".

Let's speed victory these two ways: by more war production and by buying more War Bonds!

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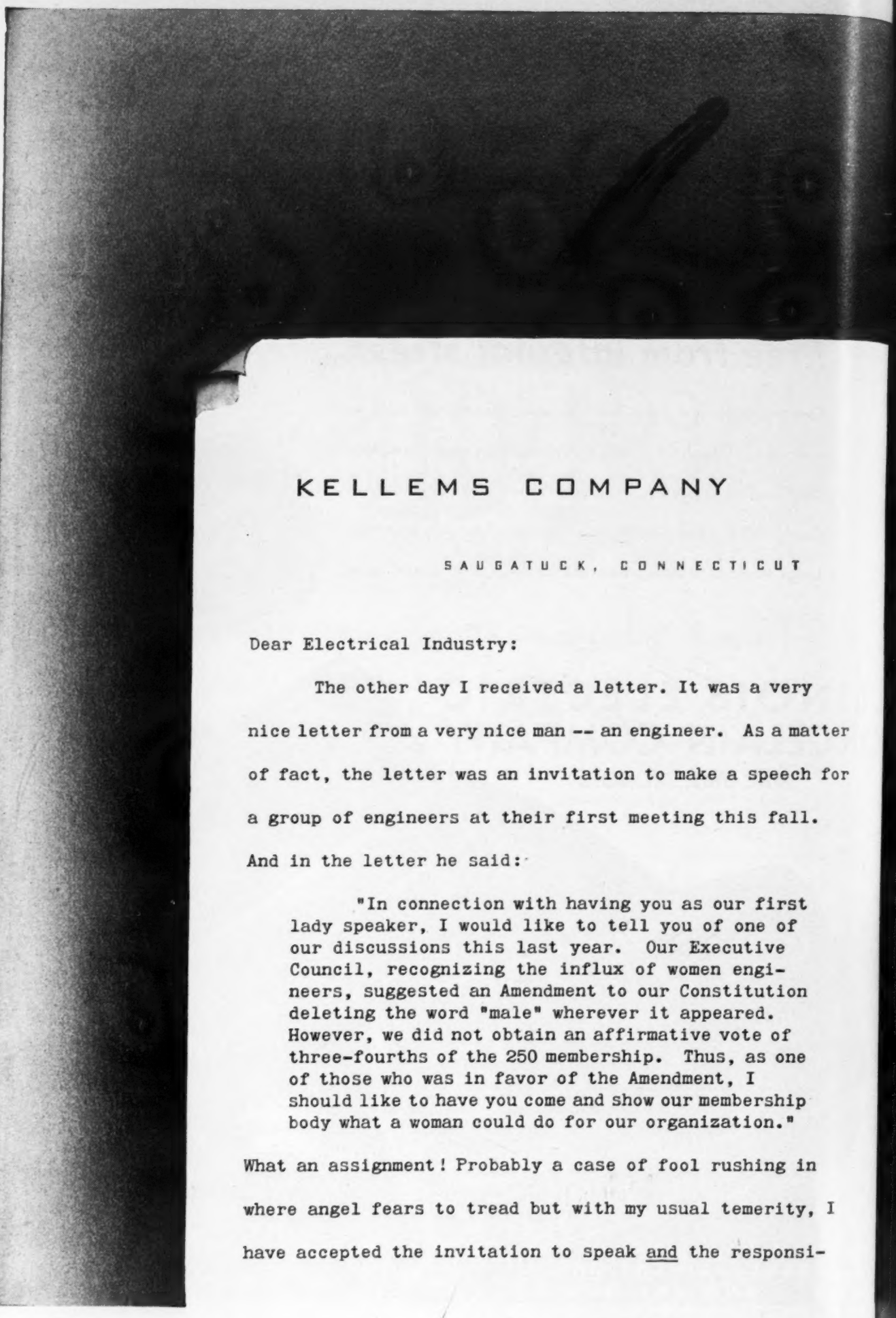

KELLEMS COMPANY

SAUGATUCK, CONNECTICUT

Dear Electrical Industry:

The other day I received a letter. It was a very nice letter from a very nice man -- an engineer. As a matter of fact, the letter was an invitation to make a speech for a group of engineers at their first meeting this fall. And in the letter he said:

> "In connection with having you as our first lady speaker, I would like to tell you of one of our discussions this last year. Our Executive Council, recognizing the influx of women engineers, suggested an Amendment to our Constitution deleting the word "male" wherever it appeared. However, we did not obtain an affirmative vote of three-fourths of the 250 membership. Thus, as one of those who was in favor of the Amendment, I should like to have you come and show our membership body what a woman could do for our organization."

What an assignment! Probably a case of fool rushing in where angel fears to tread but with my usual temerity, I have accepted the invitation to speak and the responsi-

bility of trying to make those dear engineers woman-conscious.

You see, we're going to emerge from this war into a changed engineering world. Women are going to be in it and furthermore they are going to want to stay in it. Quite rightly so. If they help win this war with their engineering knowledge and ability, isn't it possible they can make a contribution to the solution of peacetime problems? It's a question pecularly pertinent to the Electrical World.

And so Dear Industry, may I ask you a question? What part are women going to play in <u>your</u> postwar world?

Sincerely yours,

Vivien Kellems

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in over three-quarters of a century of continuous production, has established a record of performance that is unequalled in the history of insulated wires and cables.
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Unified Information

A generation ago there flourished throughout the country a unified public utility information service nationally directed and locally operated. One of its aims was to tell the same story everywhere at the same time. With the Federal Trade Commission investigation and report this service was largely repudiated and, except for vestiges, it has disappeared. The need, however, continues and, if anything, is greater today than ever before.

The public has to be informed and a splendid start is being made in that direction by the utilities' national advertising and radio program.

The employees need to be informed and, while there are several programs being conducted by individual companies, there is no uniformity to the subject matter or to the manner of presenting it.

Those who make the laws under which utilities are regulated also need information. Largely through fear nothing of an organized nature is being done at Washington, while in the states, where personal contact is easier, nothing of a unified nature is done because the industry hasn't appreciated the necessity.

A unified electric utility information service is needed right now. Not a propaganda service that broadcasts opinions secured from experts, for nothing would be worse than an attempt to give testimony in the Hollywood cigarette fashion. Likewise are we opposed to a lobby to influence legislation by political means. All that we have in mind is the dissemination of "the truth, the whole truth and nothing but the truth."

With a well organized activity it would be possible to tell legislators, employees and the public the same facts at the same time and by so doing make the knowledge stick better. If the employees of each company get different information differently interpreted there is bound to be confusion, for it will not fit in with the national advertising program nor will it be accepted by those who move from place to place. Employers who operate in several places will be distrustful. The full force of such information can be realized only in an organized and unified service.

Somebody said recently if every one of the 250,000 utility employees each told the same fact to but ten people in a month it would mean that two and a half million people would be so much better informed that month. Multiply that by twelve and see what the possibilities are for just one year. Is that getting too wishful? Well, slice it any way you want and it's still considerably more than we have now.

Besides there are by-products to this thought of a unified utility information service, such as rebuilding the romance of electricity, such as re-creating the desire to work in this industry, such as re-stimulating investing confidence, such as re-establishing the faith of industry executives that there is a future that is worth while.

The old distrust that has kept the industry apart is gradually being broken down by the advertising campaign. Perhaps the day is not far off when the industry can take the next step of a unfied information service. It should be under way now—Let's not wait too long.

Simplicity and Versatility Stressed in Akron Addition

Design for efficiency at base-load, light-load and overload involves four-stage heating, the omission of some reaction rows, marginal capacities in boiler and turbine — Furnace and fly ash to elevated tank

GEORGE C. DANIELS, Mechanical Engineer, Commonwealth & Southern Corporation, Jackson, Mich.

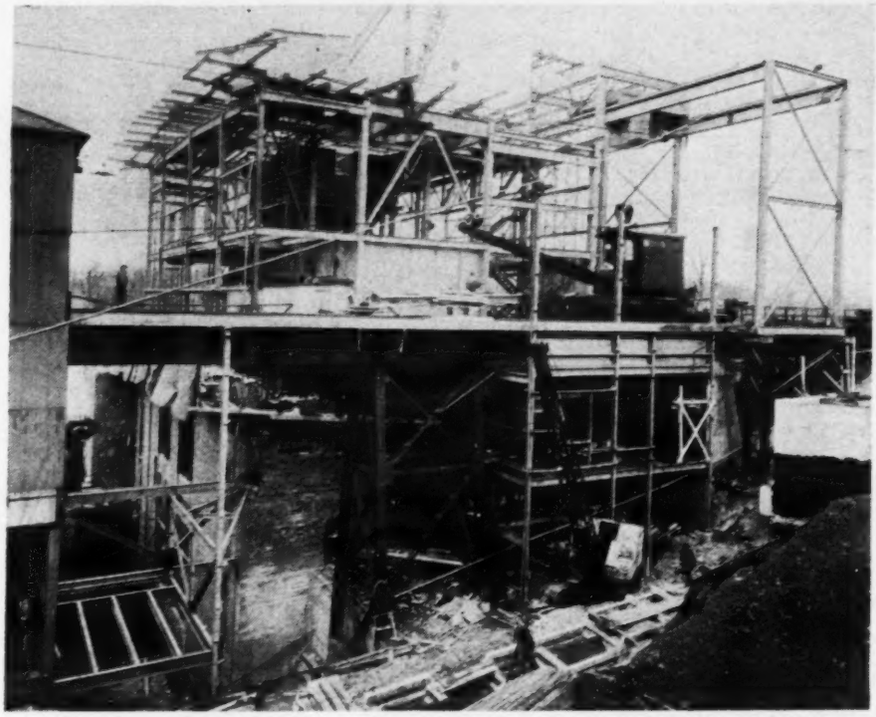


FIG. 1—Plant on gorge slope receives coal at upper level; boiler-room side under construction; coal bunker housing (at left) for original plant (rear)

AKRON, one of the important load centers of the Ohio Edison Company, has been served by a generating station of approximately 60,000 kw. capacity built in the period from 1912 to 1918. The growth of load in this area subsequently necessitated two interconnections at 138 kv. with neighboring utilities and other generating stations within the system in adjacent areas. In 1940 the decision was reached to build a 35,000-kw. addition to the present station despite the higher fuel costs at this location and the shortage of circulating water because it would give the most reliable service possible to the rapidly growing power requirements of this area with the minimum system losses and, furthermore, would be more economical in first cost due to the fact that the existing transmission substation and the 24,000-volt transmission system were adequate to handle the additional generating capacity with but few changes.

Construction was started in June, 1941, and the completion of the installation was scheduled for the latter part of 1942, but due to difficulties in securing material and labor the unit was not able to be made ready for operation until the middle of 1943. Fig. 1 shows an early stage of construction and a general view of the project.

The original plant was built for a steam pressure of 200 psi. with five turbines having a total rated capacity of 67,000 kw. and 24 stoker-fired boilers. It is built into the side of a narrow, rocky ravine on the shore of a pond formed by a dam across the small stream about ½ mile below the plant site. Surface area of the pond is some 41 acres with a maximum depth of about 50 ft., giving a total volume of water of about 46,000,000 cu.ft.

Condensing Limitations

Circulating water intake for the new addition is located 30 ft. below the normal water surface and the discharge of both the present and new addition is some 400 ft. downstream (Fig. 2) and near the pond surface, thus allowing the warm discharge water to flow downstream if the stream flow is greater than the plant requirements and to recirculate when the stream flow is less. The plant lies close to the divide between adjacent river basins and consequently the drainage area of the stream above the plant is quite small, and of this area 63 percent is utilized for municipal water supply leaving only 122 square miles of drainage area for the plant supply, which has resulted in stream flows as low as 9 c.f.s. in daily average.

Stream flows will be limited by the

heat-dissipating ability of the pond. The higher thermal efficiency of the new unit and the use of the regenerative cycle will require only approximately 36 percent as much heat to be removed by the circulating water as required by the old plant for the same capacity.

Site on Steep Slope

The plant is built into the steep sides of the ravine and this required considerable rock excavation under the boiler room and, due to the steep slope of the ground, required some caissons to rock under the turbine room and intake structures. The base-

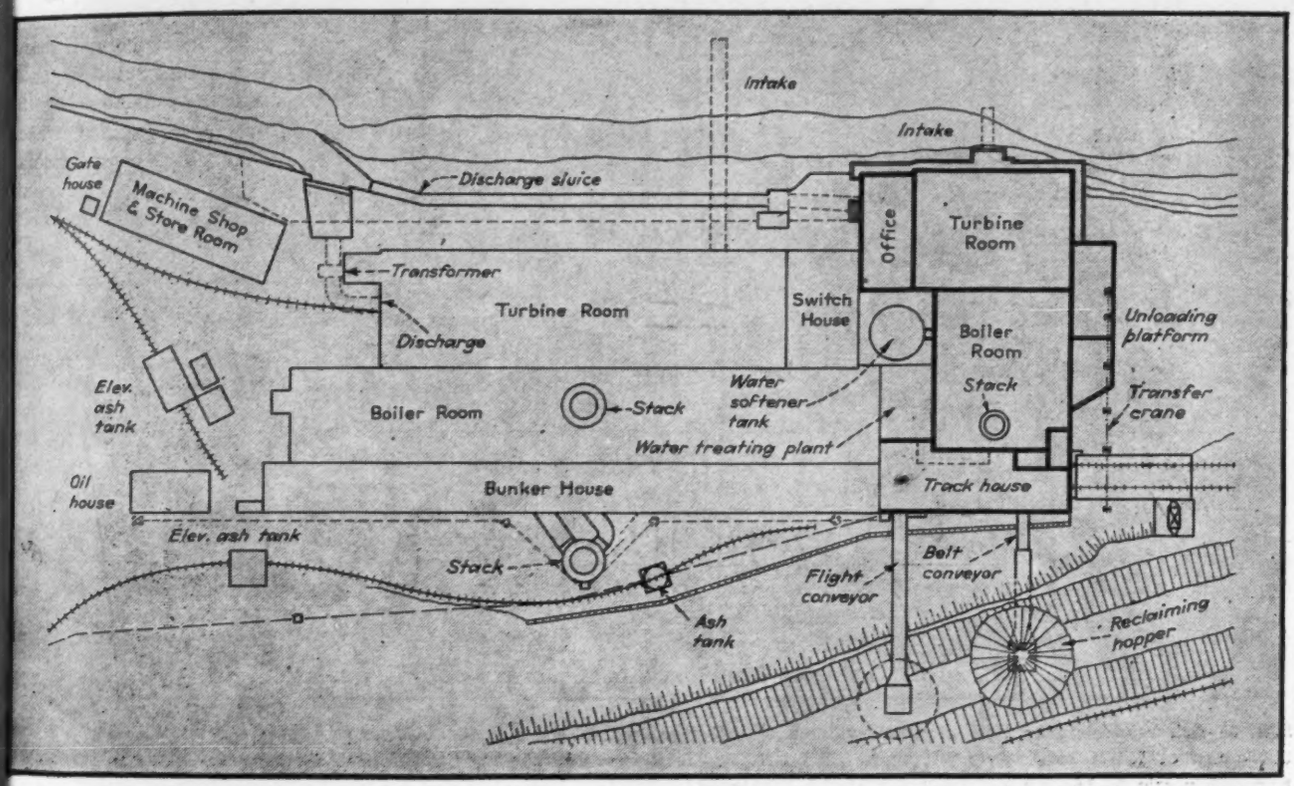


FIG. 2—Coal storage (27,500 tons in 1,050-ft. main pile) at top of bank; there is a supplementary storage at each end of the plot; condensing water circuit arranged for recirculation at low river flows

ment or pump room floor is 4½-ft. above normal water level at the crest of the dam and high water level is only 6 in. above the basement level. The coal and equipment track is 105½-ft. above the basement floor and it was necessary to handle most of the construction material and all of the plant equipment from this elevation. The only other approach to the new addition was a narrow road between the old plant and the shore. To handle the plant equipment during installation and for subsequent removal or replacement of equipment a transfer crane of 100 tons capacity has been installed on the upstream side of the building that can handle equipment from the railroad track to the turbine room operating floor 63½-ft. below the track elevation or to the boiler room fan floor 14 ft. above the track.

The turbine is designed for 800 psi. and 900 deg. operation and has a nameplate rating of 35,000 kw., designed not only to operate very efficiently on base load but also to operate satisfactorily at very light loads, and in emergencies to carry extreme overloads successfully. Four stages of feedwater heating are employed, with two low- and two high-pressure heaters. While the fourth stage heater shows little economic advantage, there will be periods of light load operation when this unit will be used as spinning reserve, and under these conditions the feedwater temperature without the fourth heater would be too low to prevent economizer and air preheater corrosion.

The area in which this plant is located normally receives a large portion of its power by transmission line and in the event of line trouble it is necessary to generate as much power as possible at this station. To increase the overload capacity of the turbine the design was modified to permit passage of approximately 450,000 lb. per hour of steam instead of 400,000 to 425,000 lb. per hour, which has been usual for this type of turbine. This was done by omitting the first two rows of reaction blading following the impulse blading which will permit the unit to carry about 50,000 kw. The hydrogen-cooled generator is capable of carrying this overload during emergencies at the expected power factor. Omission of the first two rows of reaction blading will only increase the average water rate by about one-quarter of 1 percent.

Dry-Bottom Boiler

The 450,000-lb. per-hour steam generator was designed to have the same general dimensions as one of 400,000 lb. per hour capacity, with sufficient fuel burning and mechanical draft equipment to get the additional 50,000 lb. per hour when required; a wide range of superheater control is also provided. For this

condition a dry bottom, completely water-cooled furnace will be used, employing a maximum heat release of 27,000 B.t.u. per cu.ft. per hour, which is some 10 percent higher than would ordinarily have been used for continuous operation. Three unit pulverizer mills and six turbulent burners will give flexibility over a wide range of load.

Forced and induced draft fans are inlet-vane controlled and are driven by two constant-speed motors, one on either end of the fan. Steam outputs corresponding to nearly full rated load on the turbine can be carried by the smaller motor and greater loads will be carried by the larger motor.

Condensate Deaeration

Condensate deaeration will be accomplished entirely in the condenser, with no deaerating feedwater heaters installed. The condenser hotwell has been made somewhat larger than usual, so that it can be used as a surge tank. This makes it necessary to operate the turbine and boiler as a unit, but this is not objectionable in this case as an additional high-pressure unit for this station is not contemplated for the near future. When another unit is installed a new common surge tank will be used to allow cross-connection of the units. Since no feedwater treatment is to be used, special attention was paid to getting pure steam from the evaporator, which will be provided with a bubble cap washer to wash the steam with the incoming feed and then passing it through a moisture eliminator. The evaporator feed will be treated water from a hot process lime and soda softener which serves the 200-lb. pressure boilers in the old plant.

To provide for very light load operation as well as heavy overloads three boiler feed and three condensate pumps are provided, any two of which will have capacity for the maximum loads.

Fly-Ash Disposal

Disposal of fly ash from the multicyclone dust collector and boiler soot hoppers and the furnace ash at this plant presented some unusual problems. No place was available in the vicinity to which to sluice the ashes and any water returned to the pond would have to be clarified, since the pond is used for recreational purposes. To meet these conditions the furnace ashes are pumped into a dehydrating storage as in Fig. 3, the top of which is about 100 ft. above the ash pump. Fly ash from the dust collector and boiler soot hoppers is handled by a water jet evactor to a separating tank, thence by gravity to the storage tank. Only a small quantity of fly ash will collect in the bottom of the stack and can be removed when necessary by sluicing to the ash storage tank. Overflow from the 33,800-gal. dehydrating storage tank goes to the inner compartment of the 46,700-gal. recirculating tank, where the ash in suspension settles to the bottom and the clarified water overflows to the outer compartment. Flap valves between the two compartments maintain water in the inner compartment as long as there is water in the outer compartment.

Furnace ash hopper is of the flooded type so that the ash and slag will fall into the water and the molten slag will disintegrate. When the hopper is full and ash is to be removed the ash pump is started and one of the ash removal doors partially opened to drain the water into the sluiceway. This door is then opened fully and the ash jet pump started and the ash in this compartment washed out by an oscillating nozzle in the front and fixed jets in the rear of the hopper. After the four com-

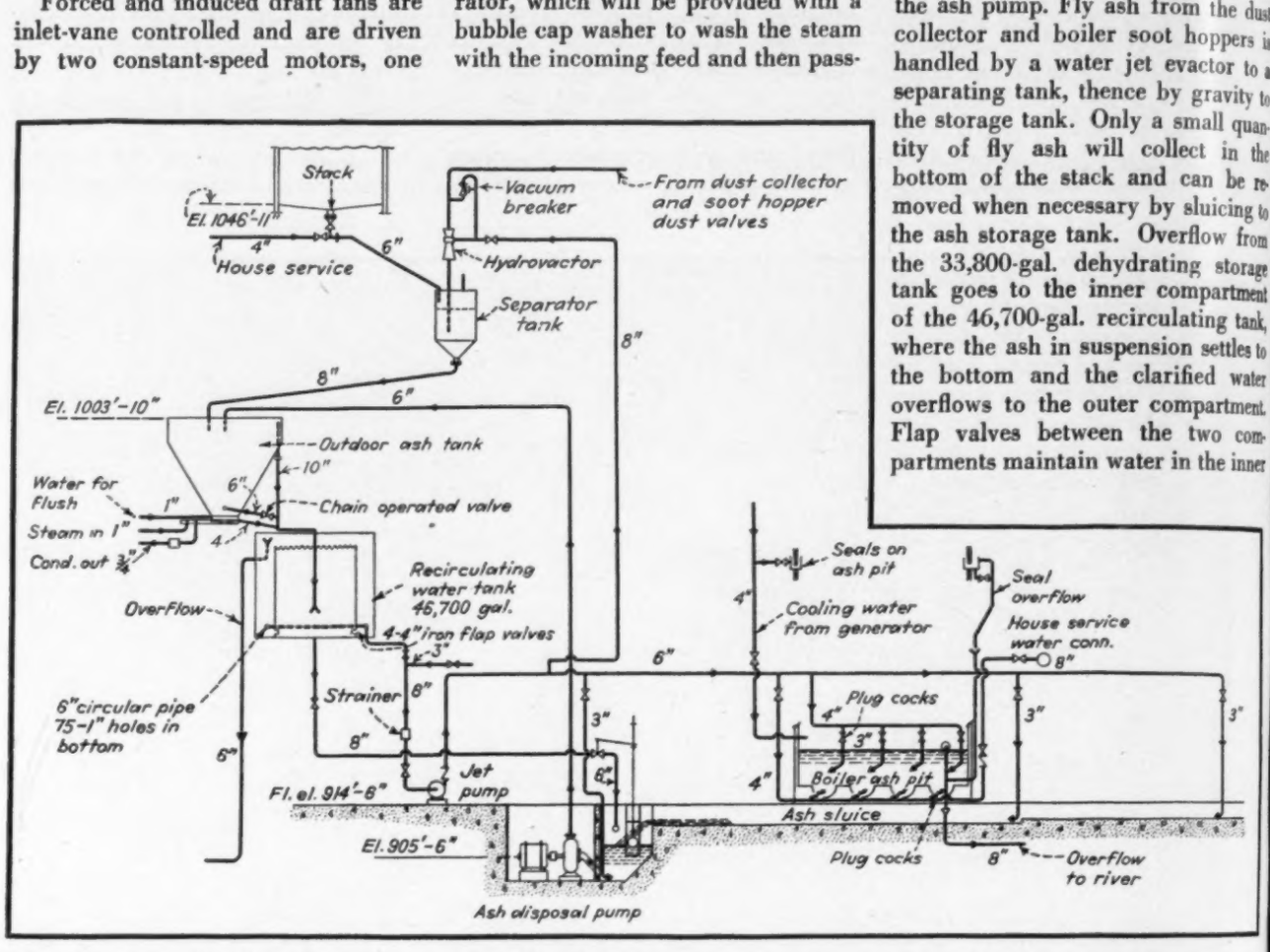


FIG. 3—Ash-disposal-piping flow diagram; volume of boiler ash pit to water line. 1,116 cu. ft. (8,700 gal.); ash disposal pump, 900 g.p.m. at 133 ft. total head; jet pump, 650 g.p.m. at 330 ft. total head; hydrovactor, 650 g.p.m.; transport nozzle A, 225 g.p.m.; transport nozzle B, 175 g.p.m.; oscillating nozzle, 175 g.p.m.

partments are emptied the pit is filled with water as quickly as possible by opening all of the jets and flooding pipe. The jets are then closed and the hopper kept flooded with waste water from the turbine oil coolers. Overflow from the top of the hopper runs to the pond. Make-up to the ash pump to keep the velocity in the discharge pipe to a minimum of 10 ft. per second is supplied from the inner compartment of the recirculating tank, which also removes the precipitated fine ash that may settle in this tank. The jet pump for operating the water jet evactor for fly ash removal and for sluicing ashes is taken from the clear water outer compartment of the recirculating tank.

After all of the furnace and fly ash has been sluiced to the dehydrating storage tank the tank is drained into the recirculating tank and any excess water which will be clarified will flow to the pond. From the storage tank the ashes can be removed by rail or truck.

Arrangement for handling coal for the old portion of the plant was very simple. Coal was dumped from railroad cars or trucks directly into the top of the bunkers and storage coal was unloaded by locomotive cranes alongside of several tracks running the length of the narrow coal yard (Fig. 2). Necessity of providing additional coal storage capacity in the limited space available and supplying the new coal bunkers located at a higher level than the old bunkers resulted in an unusual design of coal-handling equipment (Fig. 4), which was adopted after careful investigation of all possibilities.

By the elimination of all but one of the railroad tracks in the coal-handling area and using a bulldozer and wheeled scraper to handle storage coal, the capacity of the coal storage area was increased many times and at the same time spontaneous combustion in the pile prevented. To get the maximum compaction in the storage pile all coal for storage will be screenings or will be crushed.

Coal can be delivered in railroad cars or trucks:

1. To the hoppers under the railroad track at the new boiler room, thence to the new boiler bunkers or to the stock pile.

2. Directly into the bunkers of the old boilers.

3. To the stock pile from trucks or unloaded from cars with a locomotive crane into storage.

From the track hopper the coal can be run through the crusher and delivered to the new bunkers by inclined and horizontal scraper conveyors or the coal can be delivered to the storage area by an inclined belt conveyor. A similar belt conveys the coal from the reclaiming hopper in the storage area to the plant. Storage coal can be supplied to the old plant by diverting the coal from the discharge of the inclined scraper conveyor through a spout into railroad cars, from which it can be dumped into the old coal bunkers.

Maximum cleanliness is obtained by means of a dust-tight inclosure around the scraper conveyor over the bunkers and by maintaining a slight suction in the bunkers and in the conveyor feeder spouts by means of exhauster fans.

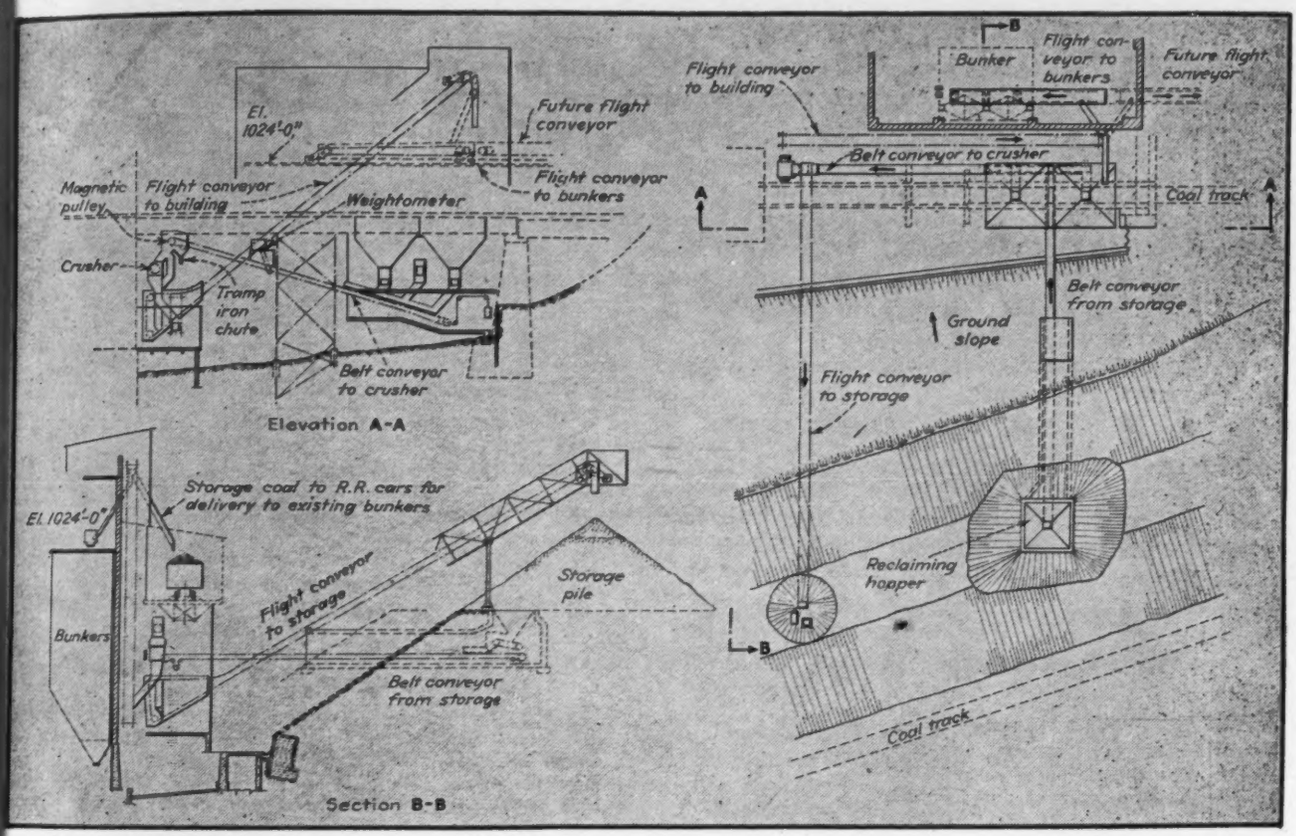
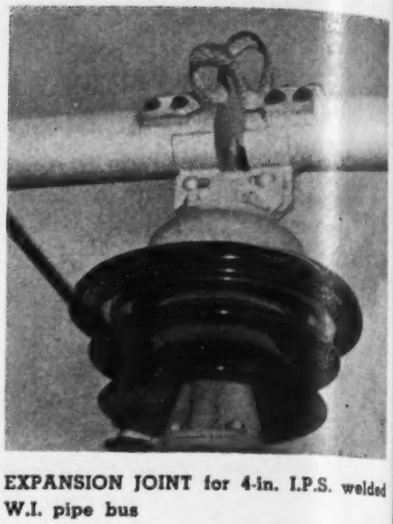


FIG. 4—Coal can be delivered from cars or trucks to the bunkers of the new or old boilers, or to the stock pile; a bulldozer and wheel scraper will distribute and reclaim storage coal.

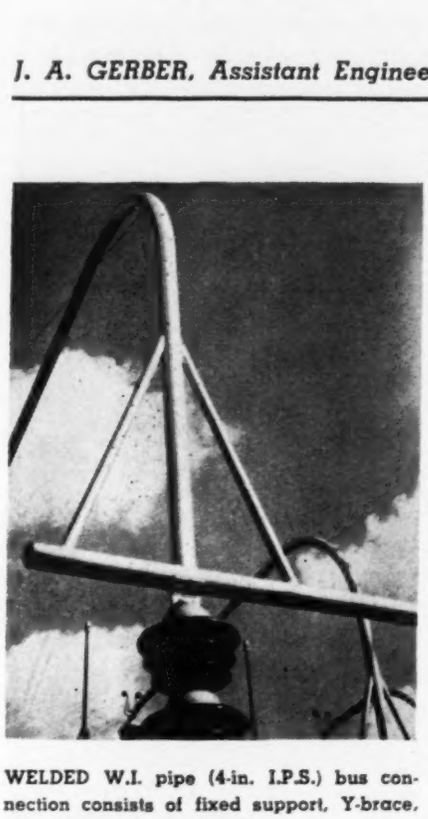
Bus Construction of Welded W. I. Pipe

Wrought-iron pipe for high-voltage buses offers significant advantages in strength for long spans, corrosion resistance, cost, expansion, fittings and appearance

J. A. GERBER, Assistant Engineer, Bonneville Power Administration



EXPANSION JOINT for 4-in. I.P.S. welded W.I. pipe bus



WELDED W.I. pipe (4-in. I.P.S.) bus connection consists of fixed support, Y-brace, corona-end-bell and bend

WROUGHT IRON PIPE with welded connections is used extensively for 115-kv. and 230-kv. buses in the substations of the Bonneville Power Administration system. After comparing it with copper, aluminum and alloy steel, it was found to possess the most desirable combination of strength, conductivity, corrosion resistance, ease of fabrication, simplicity and economy.

It is fortunate that there is a satisfactory bus metal to use these days in place of the very critical copper and aluminum. It need not be classed as an "ersatz" material; in fact, there are many points in its favor for using it for permanent buses, for instance:

1. At the above-mentioned voltages the currents in the buses of even the largest stations of this large power system were found to be well within the carrying capacity of wrought iron pipe, the largest size required being 4-in. I.P.S. standard weight. The current-carrying capacity of wrought steel pipe was published in the April 18, 1942, issue of ELECTRICAL WORLD entitled "Steel Pipe as A-C Conductor," by S. C. Killian. These figures are approximately correct for wrought iron pipe. The article also mentioned that current-carrying capacity can be increased by slotting the pipe along its length to break the ferrous loop, and by painting the pipe with a dull black paint to increase the heat emissivity.

2. It has a high modulus of elasticity, permitting long spans, particularly with ice and wind loading, thus saving considerably on insulators, fittings and supports. High voltages require wide phase spacing and long spans, requiring strong bus metals, such as wrought iron.

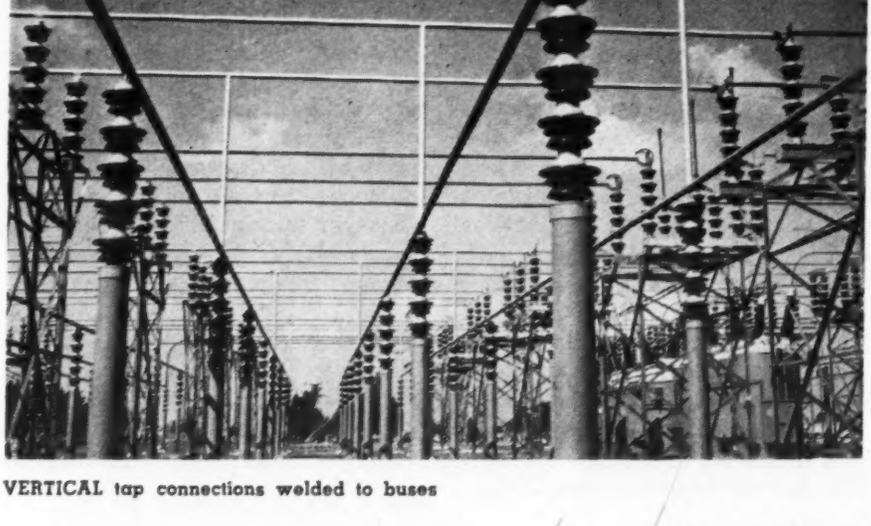
3. It has very good corrosion-resisting properties in most atmospheres. Painting is an additional protection and is easy to apply.

4. It costs less than aluminum or copper pipe of same size.

5. It expands less than copper or aluminum, requiring fewer expansion joints.

6. Welding is an easy, quick and economical way of joining the piping into whatever bus arrangement is desired. All the costly clamp type fittings are eliminated; only a few, simple, easy-to-make fittings are required. Welding produces strong, permanent joints of high electrical efficiency.

7. As can be seen in the accompanying illustrations, welded buses are quite streamlined in appearance, reducing corona formation.



VERTICAL tap connections welded to buses

No ready-made parts and fittings for welded wrought iron bus construction were found on the market. A study was made and it was found economical and feasible to make the parts in the Bonneville system's blacksmith and welding shop. No great outlay of equipment was required. The bus layouts for the substations were standardized, making possible the development of a standardized line of bus unit parts. These were quickly and accurately prefabricated with the aid of jigs of simple construction.

The horizontal portion of the Y-brace (page 64) eventually becomes part of the lower level bus. Braces made up in this manner eliminate three clamp type fittings ordinarily used, resulting in a streamlined part.

The amount of bending is determined by the number of times the pipe passes through the rollers and by the amount of pressure exerted by the free roller against the pipe. Usually, six or seven times was sufficient to pass the pipe through the machine to produce the required curvature. The pipe is usually bent into 270 deg. of curvature and is then cut to produce three standard 90 deg. bends. The machine is also used to produce a slight bend in the pipe so that, when placed in position in the field, it will deflect into a straight line. Piping bent in this machine costs only a fraction of ready-bent pipe on the market.

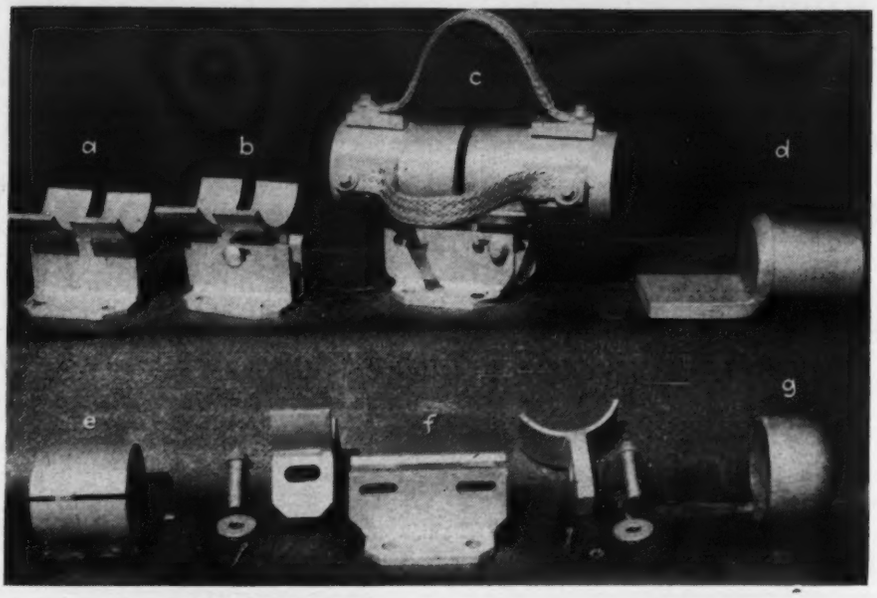
As much welding as possible is done in the shop, leaving some to be done in the field; there the pipe is welded to the bus supports and vertical taps are made.

Field Welds

In preparing a field weld the bus supports are bolted in position on top of the insulator stacks. The pipe is then laid in position with the joints in the middle of the bus supports, being previously prefabricated to the correct length, with the ends beveled for welding and with three small holes burned out 1 in. away from the ends. A short split sleeve made of pipe one size smaller, is compressed slightly and inserted inside of the pipes at the joint. The three holes at the pipe ends are filled in by welding, uniting both pipes to the split sleeve. Another weld is then made in the vee produced by the beveled pipe ends. Finally, the pipe is welded to the curved saddle pieces of the bus support. The insulators are protected from the hot welding particles by a square wood platform split in the middle, which is made to fit snugly around the top of the insulator. In addition, the insulators are wrapped with canvas or heavy paper. After the weld is made this platform is unhinged and installed at the next insulator.

A vertical bus tap is made of pipe with the ends cut out to fit the curvature of the buses for butt joining.

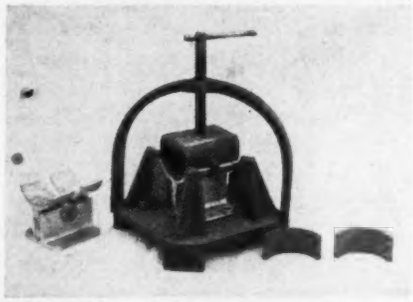
To provide a wrought-iron-to-copper connection a copper bar tongue is brazed to the pipe wherever required, to which can be bolted a copper cable or tube terminal.



WELDING FITTINGS for W.I. buses
(a) Fixed support; four pieces of plate welded, four holes in base for attachment to insulator. (b) Sliding bus support; lower part slotted to permit expansion movements. (c) Expansion bus support; comprises two items (b), with copper braid bolted to pads welded to pipe ends. (d) Terminals are of cast bronze to be brazed into pipe ends. (e) Pipe joint welding sleeve. (f) Parts for (c). (g) Corona end bell consists of 1-in. length of pipe to which dished round plate is welded.

It costs more to erect the buses in the field by welding, but this is offset by the lower cost of wrought iron pipe, by the low cost of the few fittings required, by the assurance of good, permanent electrical connections and by its superior mechanical strength. So far there has been no evidence in this system of noticeable vibration in tubular wrought iron buses.

The buses are finished by first removing the protective asphalt varnish coating which comes on the pipe, then by cleaning with an abrasive, then by a coat of synthetic red lead and, finally, by two coats of aluminum paint, which produces an attractive and long-lasting finish.



INEXPENSIVE jig holds fittings for welding operation at fraction of cost of machined equivalents

LARGE JIG for welding a straight, a bend and a Y-brace; pipe bender in foreground has two rollers driven through gear-reduction box by 5-hp. motor; third runs free, forced against pipe by worm screw

Analysis of Failures Clue to Trouble Control

Formulated reports of apparatus failures** are the **basis for critical analysis which points to preventive measures that conserve equipment and service

E. W. WHITMER, American Gas & Electric Service Corporation, New York, N. Y.

FAILURES of electrical apparatus can cause such extensive equipment damage and such untenable service interruptions that a continual vigilance for controlling these troubles is imperative, particularly during the present shortage of materials and manpower as well as the increased importance of service continuity to some customers. In general, it is believed that an accurate analysis of failure causes has been earnestly hoped for but seldom realized on an extensive basis. With these ideas in mind, an improved procedure for reporting and analyzing electrical apparatus failures has been followed in the American Gas & Electric Company's system since the early part of 1938.

Analysis Gives Results

This work has resulted in the following conclusions:

1. In order to keep electrical apparatus in first-class operating condition by application of proper maintenance and corrective measures it is necessary to keep adequate records containing analysis of failure causes.

2. The cause of electrical apparatus failures can usually be determined as herein explained by a systematic examination of the apparatus subsequent to the trouble and an intimate understanding of the equipment as well as the operating conditions and requirements.

3. The system of reporting troubles in major apparatus has helped and, no doubt, will continue to help appreciably in controlling failures at a very low rate.

4. By use of apparatus failure information it seems possible to determine where maintenance and attention are most needed. The basis is therefore created for allocation of the efforts expanded in maintenance on a definite engineering and economic basis.

Failure Form Sheet

An especially prepared form sheet used for recording failures of major electrical apparatus in substations and plants is shown in the accompanying illustration. The sheet has undergone several changes and now seems suitable for its intended use. Photographs and other supplementary field data are often attached to these sheets before they are sent to the engineering office for final review, analysis and summary.

Analysis of Failure Causes

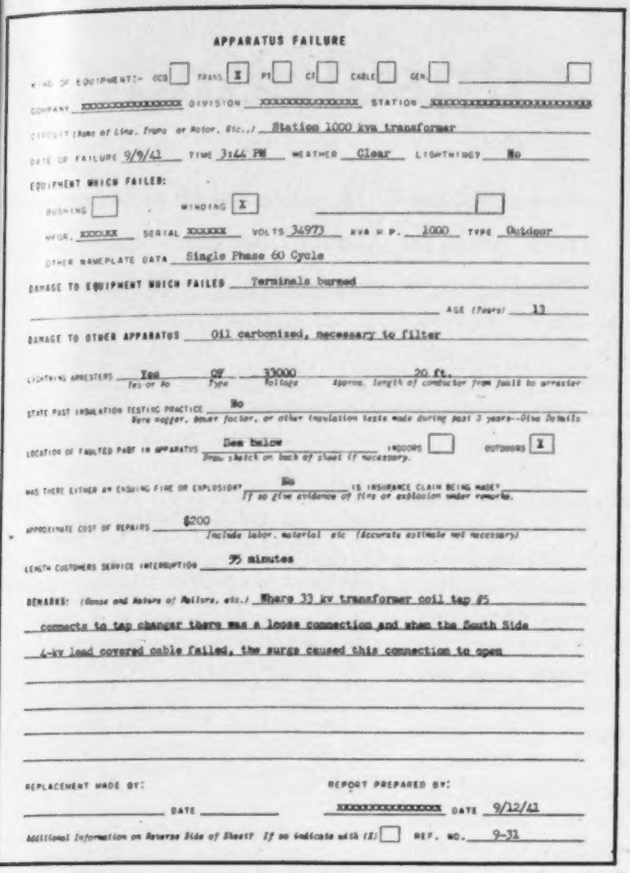
No doubt some ineffectual efforts to reduce apparatus troubles have been the result of incorrect or inadequate determination of failure causes. The accompanying chart shows the type of information considered in obtaining accurate data of failure causes. A brief discussion of this chart will serve to explain its use.

Nature and Location of Failures (Items 1 to 3)—A statement of the general nature and starting point of a failure may serve to suggest its cause to a person experienced with the apparatus. Such data may seem unimportant, but frequently proves useful when experiences with similar equipment are reviewed in the course of failure analysis.

Evidence of External Failure (Items 4 to 7)—Failures which are not caused by any actual weakness or trouble in the apparatus itself may be in the form of external flashover caused by animals, birds or other foreign objects which accidentally contact energized parts. Misinterpretations are often prevented by a thorough search for evidence of such failure causes.

Evidence of Internal Failure (Items 8 to 10)—Some failures, particularly in bushings and cable potheads, show very definite evidence of excessive pressures having taken place inside the failed part. This may be indicated by porcelain fragments which have been thrown off with considerable force, by a bulged cable sheath just below the pot-head, or a bulged bushing ground shield. Such conditions indicate that the trouble originated internally and usually simplify the task of determining the cause of failure.

Migration of oil into the compound chambers of bushings and potheads may reduce the internal expansion space to a point where high pressures result in mechanical damage and



APPARATUS FAILURE

KIND OF EQUIPMENT:- OCB ☐ TRANS ☒ PT ☐ CT ☐ CABLE ☐ GEN ☐ _____ ☐

COMPANY XXXXXXXXXXXXXXX DIVISION XXXXXXXXXXXXXX STATION XXXXXXXXXXXXXXXXXXXXX

CIRCUIT (Name of Line, Trans or Motor, Etc.,) Station 1000 kva transformer

DATE OF FAILURE 9/9/43 TIME 3:44 PM WEATHER Clear LIGHTNING No

EQUIPMENT WHICH FAILED:

BUSHING ☐ WINDING ☒ _____ ☐

MFGR. XXXXXX SERIAL XXXXXX VOLTS 34973 KVA H P. 1000 TYPE Outdoor

OTHER NAMEPLATE DATA Single Phase 60 Cycle

DAMAGE TO EQUIPMENT WHICH FAILED Terminals burned

_____ AGE (Years) 13

DAMAGE TO OTHER APPARATUS Oil carbonized, necessary to filter

LIGHTNING ARRESTERS Yes (Yes or No) GW (Type) 33000 (Voltage) 20 ft. (Approx. length of conductor from bushing to arrester)

STATE PAST INSULATION TESTING PRACTICE No (Core loggor, power factor, or other insulation tests made during past 3 years--Give Details)

LOCATION OF FAULTED PART IN APPARATUS See below (From sketch on back of sheet if necessary.) INDOORS ☐ OUTDOORS ☒

WAS THERE EITHER AN ENSUING FIRE OR EXPLOSION? No IS INSURANCE CLAIM BEING MADE? _____ (If so give evidence of fire or explosion under remarks.)

APPROXIMATE COST OF REPAIRS $200 (Include labor, material etc (Accurate estimate not necessary)

LENGTH CUSTOMERS SERVICE INTERRUPTION 95 minutes

REMARKS: (Cause and Nature of Failure, etc.) Where 33 kv transformer coil tap #5 connects to tap changer there was a loose connection and when the South Side 4-kv lead covered cable failed, the surge caused this connection to open

REPLACEMENT MADE BY: _____ DATE _____

REPORT PREPARED BY: XXXXXXXXXXXXXX DATE 9/12/43

Additional Information on Reverse Side of Sheet? If so indicate with (X) ☐ REF. NO. 9-31

FORM SHEET records and reports details of major electrical apparatus failures for subsequent analysis

ITEMS CHECKED IN DETERMINING THE CAUSE OF FAILURES

Item No.	ITEM TO CHECK	Bushings	Cables and Pothead	Capacitors	Fuses	Induction Regulators	Insulators	Lightning Arresters	O.C.B.'s.	Rotating Machinery	Transformers
1	Point Where Failure Started	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Puncture Through Insulation	✓	✓	✓		✓	✓			✓	✓
3	Creepage over Internal Surfaces	✓	✓	✓		✓		✓	✓		✓
4	Evidence of External Flashover	✓	✓	✓	✓		✓	✓			
5	Excessive Dirt Deposits	✓	✓	✓			✓	✓		✓	
6	Presence of Birds, Animals, Etc.	✓	✓	✓			✓	✓			
7	Foreign objects - Thrown Rocks, Wire, Etc.	✓	✓	✓			✓	✓		✓	
8	Evidence of Internal Pressure	✓	✓	✓				✓			
9	Migration of Oil into Compound	✓	✓								
10	Voids in Compound	✓	✓								
11	Old Cracks in Porcelain	✓	✓	✓				✓			
12	Evidence of Moisture Leaks Thru Gaskets	✓	✓	✓		✓			✓		✓
13	Evidence of Moisture Leaks Thru Breathers	✓				✓			✓		✓
14	Leaks in Water Cooling Coils									✓	✓
15	Excessive Moisture While Idle or Spare	✓				✓				✓	✓
16	Moisture Leaks Above Oil Level	✓				✓			✓		✓
17	Evidence of Condensation	✓	✓			✓		✓	✓		✓
18	Excessive Moisture From Other Sources	✓	✓	✓		✓		✓	✓	✓	✓
19	Moisture Leaks Located By Pressure Tests					✓			✓		✓
20	Moisture Indicated By Insulation Tests	✓	✓	✓		✓		✓	✓	✓	✓
21	Evidence of Excessive Lightning Voltage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
22	Lightning Arrester Location and Data	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
23	Insulation Strength of Equipment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
24	Simultaneous Failure of Other Equipment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
25	Evidence of Mechanical Weakness, Etc.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
26	Tightness of Coils					✓				✓	✓
27	Caused By Loose or Broken Connection	✓	✓	✓	✓	✓				✓	✓
28	Condition of Insulating Oil	✓	✓	✓		✓			✓		✓
29	Previously Shorted Laminations at Failure					✓				✓	✓
30	Insulation Weakness Between Turns					✓				✓	✓
31	Evidence of Corrosion Electrolysis, Etc.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

CHART tabulates items checked in course of determining the causes of failure of electrical equipments

make way for such things as moisture entrance. Voids in filling compounds may cause failure by promoting moisture absorption or by lowering the normal impulse strength of the compound filled member.

Evidence of Moisture Entrance (Items 11 to 20)—Excessive moisture is often present for a long time prior to failure, and there is usually evidence to indicate such a condition. Some clue can usually be found, such as rust on iron parts below oil levels as well as rust and corrosion above oil levels. Power factor or other insulation tests are also useful in indicating general, moist conditions. The most common points of moisture entrance include (1) old cracks in porcelain members, (2) partially obstructed breathers, (3) breathers which have their openings directly above the apparatus cover, (4) felt gaskets, (5) some types of fiber gaskets, and (6) deteriorated cork gaskets. In conservator transformers the tops of explosion relief standpipes and bushings are vulnerable points of moisture entrance. Air pressure tests are sometimes used to locate leaks and often reveal rather unexpected points of possible moisture entrance. In taking care of apparatus where failure has been caused by moisture, it is necessary to find the point of entrance and take corrective measures if recurrence of similar troubles is to be prevented.

Evidence of Excessive Lightning Voltage (Items 21 to 24)—Some failures credited to lightning overvoltages, no doubt, actually result from weaknesses in the insulation. An analysis by comparing the lightning arrester characteristic to the insulation strength of the apparatus usually helps to determine the probable presence of excessive lightning voltage. For such an analysis one must know (1) the arrester characteristics, (2) the insulation strength of the apparatus, and (3) the distance along the conductor from the part that failed to the arrester and return through grounded parts. Sometimes simultaneous failure or flashover of two or more pieces of apparatus serves as strong evidence of lightning overvoltage. If several indications point toward the probability of lightning overvoltage the cause of failure is normally classed as "lightning." Even though a failure may have occurred during a lightning storm, if there are no indications of overvoltages, the cause of the trouble was probably something else, such as insulation weakness.

Mechanical Troubles (Items 25 to 27)—Possibly 15 percent or so of electrical failures are caused by troubles which are more or less of a mechanical nature. Sometimes coils in wound apparatus become loose, and due to continuous movement the insulation wears away to such an extent that failure takes place. In other instances the insulation may become too weak mechanically to support suitably conductors and other insulating members, thus resulting in distortion and eventual electrical failure. Failures caused by loose or broken electrical connections may in general be classified in the group of mechanical

troubles of one kind or another which must be recognized and continually watched for in determining the cause of electrical failures.

Miscellaneous Evidence (Items 28 to 31)—Other miscellaneous items are shown in the accompanying table as possible causes of electrical apparatus failures. Of these possibly the most important are the condition of insulating oil and corrosion or chemical actions of various kinds.

General Discussion

In determining the cause of failures, much depends on the person or persons making the investigation. Damage at the point of failure is sometimes so extensive that the entire investigation has to be based on the condition of undamaged portions. While an engineering analysis is quite often necessary, considerable resourcefulness and imagination have often been demonstrated by workmen and other field men who are present during actual repair work. Training of personnel along the lines of failure-cause analysis may not only make way for obtaining accurate data but should create a more thorough understanding of maintenance requirements for preventing apparatus troubles.

The better performance of some types of equipment is to some extent a reflection of differences in service requirements and life expectancy. These considerations have to be weighed carefully when using failure data as an indication of need for additional maintenance and attention.

Failure Data Obtained

Failures experienced during a five-year period in major electrical apparatus at substations and plants have been approximately as follows:

Apparatus	Percentage of Total Number of Failures
Bushings (in outdoor O.C.B.'s and transformers operating 11 kv. and up)	34
Cables and potheads (installations of short underground runs operating 2.3 kv. and up at stations)	9
Rotating machinery (generators, motors, etc., 10 h.p. and larger)	20
Oil circuit breakers (outdoor operating 11 kv. and up)	4
Transformers (oil-filled, including power, distribution and instrument types)	20
Miscellaneous (including insulators, lightning arresters, induction regulators, etc.)	13

Insulating Oil Re-

Three batches of 15 gallons each per hour mixed with retrol for heating, agitation and vacuum-filtering at a cost under 8 cents per gallon

B. C. STUDENY, Pennsylvania Electric Company, Johnstown, Pa.

FOR a number of years many utilities, as well as industrial organizations, have been faced with the problem of reconditioning insulating oils. The vast sums of money invested in oil made it prohibitive to discard the bad oil and replace it with new. On the other hand, costly equipment, such as transformers, oil circuit breakers and other electrical equipment using insulating oils, could not operate efficiently nor without serious failures of the equipment unless the insulating oil was kept in good condition.

Utilities have experimented quite extensively with various methods of reclaiming or reconditioning insulating oils and some of them have built very elaborate reconditioning units, a few of which have operated very successfully.

Pennsylvania Electric Company has made a study of this problem, as well as a thorough investigation of the equipment and methods used by other companies. Each type of oil reclaiming equipment studied had several features which were objectionable. Therefore, definite specifications were prepared which would have to be incorporated in any type of oil-reclaiming equipment, either constructed by this company or purchased from some manufacturer. Some of the major requirements of these specifications were as follows:

1. Complete removal of water, light volatile unsaturates, kerosene and other products of a like nature.
2. Complete removal of higher boiling point, high molecular weight compounds, such as sludges, acids, waxes, soaps, varnish, gums, resins and polymerized compounds which are built up during service and by oxidation.
3. Complete removal of solid substances, such as dust, grit, metallic particles, adsorbent materials and most colloidal sized substances.
4. Reclaim not only insulating oils but lubricating oils and turbine oils.
5. The equipment could not involve any of the hazards encountered in the re-refining of oils wherein alkalies and acids are used as a portion of the process.
6. Low-cost operation, both from the standpoint of materials and labor.
7. The equipment would have to be portable. Due to the large area served by this company, the transportation costs of hauling oil to and from the reconditioning unit would be too costly.
8. The equipment would have to be a batch type.

Re-refiner Purchased

R. P. Dunmire, vice-president of the Buckeye Laboratories, had been experimenting for a number of years with various types of refining units suitable for the reclaiming of all types of oils. Mr. Dunmire was consulted and it was found that a re-refiner which he had developed would meet our specifications.

In 1942 this company purchased from Buckeye Laboratories a type AVB-15 Oilrite re-refiner (Figs 1 and 2). This re-refiner has a capacity of 45 gallons of oil an hour. This refiner is a complete adsorbent type refinery, so designed as to be easily handled by the most inexperienced persons. It can also be mounted on a truck and used as a portable unit.

Removal of water, light volatile unsaturates and other products of a like nature is readily accomplished by low-temperature vacuum distillation.

Higher boiling point, high molecular weight compounds, such as sludges, acids, waxes, soaps, varnish, gums, resins and polymerized compounds which are built up during service and by oxidation, are removed by the well-known process of adsorption.

Solid substances such as dust, grit, metallic particles, adsorbent materials

Oil re-refined Safely, Simply, Soundly

and most colloidal sized substances are removed by either vacuum or pressure filtration.

All dirty oil before it is run through the re-refiner is given a preliminary cleaning to remove water and suspended solids. This is done by passing the oil through a Hydroil centrifuge and first filter, and pumped into the dirty oil storage tank. This operation is done for three reasons.

1. To prevent accumulation of large quantities of sludge and dirt in the dirty oil storage tank and the pipe line between this tank and the re-refiner unit.
2. To remove as much water as possible before the oil enters the re-refiner.
3. Although the re-refiner will remove all sludges and every trace of moisture without this preliminary treatment, we have found that the rating of the re-refiner can be increased from 45 gallons to 50 gallons per hour by the preliminary cleaning. The less moisture and solid substances the oil contains the less time is required to re-refine. Also, the efficiency of the adsorbent material is increased and thereby a smaller amount of this material can be used.

Re-refining a Simple Operation

Operation of the re-refining equipment is exceedingly simple. A charge of oil, 15 gallons, is transferred from the dirty oil storage tank "A" by means of gravity, through the heat exchanger "E" to the slurry mixer "B."

A charge of activated adsorbent material, such as Retrol, is passed from the adsorbent hopper "H" into the slurry mixer "B." The cap is then placed on the slurry mixer, after which the adsorbent material and dirty oil is thoroughly mixed so as to form a slurry.

The charge in the slurry mixer "B" is then transferred by means of vacuum to the expansion tank "I," whence it drains downward into the retort "C". This is accomplished by using the vacuum pump "L."

After the oil has drained into the retort the agitator motor and heaters are turned on. Oil and adsorbent materials are kept agitated during the entire time the mixture is being heated. Temperature of the mixture is raised to 280 F. This temperature was found to give the best results when re-refining insulating oils. The temperature, however, must be increased for heavier oils. Motor oil requires a temperature of 600 F. A thermostat automatically cuts off the heat when the desired temperature is attained. While this operation is taking place in the retort, the vacuum pump "L" is started and withdraws the vapors, resulting from treatment through the expansion tank "I," and through the condenser "J," wherein the condensible vapors are reduced to a liquid which is trapped and held in the condensate tank "K," from which they may be drained out periodically. The non-condensible vapors pass on through the condensate tank "K," thence through the vacuum pump and vented to atmosphere.

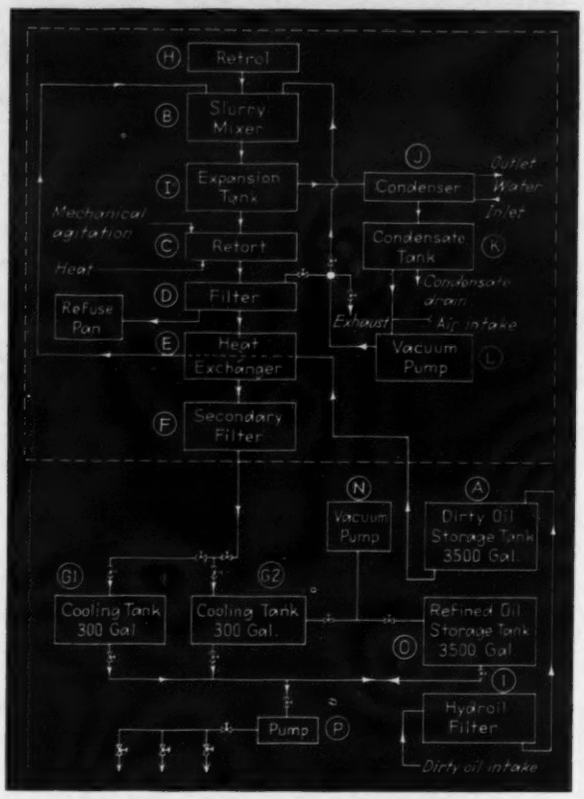


FIG. 1—Flow diagram of used oil through preliminary and definitive stages of re-refining process. Equipment within dotted rectangle was supplied by the manufacturer; the rest was provided by the utility company

While the aforementioned operations are taking place the filter head is lowered and the crank on the dirty paper roll is rotated, thereby discharging the filter cake into the refuse pan "M," and the used paper rolled up on the used paper roll, thus causing a clean area of paper to cover the entire filter head, after which the filter head is raised into its closed position. The filter is ready for operation.

A valve located between the retort and filter is opened, allowing the degasified and dehydrated oil, together with the adsorbent material, to drop down into the primary filter chamber "D," after which vacuum pump "N" pulls the treated oil through the cake of adsorbent material, which is in turn supported by the filter paper.

The filtered oil, after leaving the filter head, is passed through the heat exchanger "E," where its temperature is greatly reduced.

From the heat exchanger "E" the oil passes into a secondary filter "F," where it is filtered a second time, merely as a precautionary measure. This is a glass cloth type filter and is used as an extra precautionary measure to prevent any solid materials or adsorbent material from being discharged with the oil, in the event the filter paper would break.

The oil on being discharged from the secondary filter is passed directly into either one of the cooling tanks "G1" or "G2," where it is stored under 12 in. of vacuum until the oil tem-

perature drops to room temperature, whence it is passed under vacuum to the refined oil tank "O," where it is stored under 12 in. of vacuum until used.

It should be here noted that from the time the oil leaves the slurry mixer until it reaches the re-refined oil storage tank it is under vacuum, thus eliminating any danger of oxidation which might be caused from exposure to the aid while in a highly heated condition or during the time it is stored.

Cost of Operation

When the oil is ready for use pump "P," which is an automatic constant pressure regulated pump, 25 lb. pressure, pumps oil out to distribution points against vacuum of refined oil storage tank. Oil samples are taken periodically from each oil outlet and subjected to a dielectric test. Since this system has been in use every sample of oil tested had a breakdown above 30 kv. Since this re-refinery has been in service we have re-refined 33,550 gallons of insulating oil.

The following costs on re-refining insulating oils are based on re-refining 345 gallons of oil, having a neutralization number of 0.5665 mg. KOH/gr. of oil. These costs are based on an eight-hour day and five-day week, allowing one-half hour to heat the machine on the first batch and allowing one-half hour for cleaning the machine after the last batch, the actual operating time, therefore, being seven hours.

Electric energy, 157 kw.-hr. at 0.02 kw.-hr.	$3.14
Water, 200 gal. at 0.60/1,000 gal.	0.12
Retrol, 0.88 lb. per gallon of oil—303 lb. at 0.0385 cents per lb.	11.66
Labor, 16 hours at 0.65/hour	10.40
Depreciation	1.44
	$26.76

(Cost per gallon to re-refine—$0.078)

There is a small amount of oil remaining in the clay which is lost. This amounts to approximately 0.07 gallon per gallon of refined oil, or on a day's run of 345 gallons, about 24 gallons lost. This oil, however, cannot be charged against the cost of re-refining as it would be considered a complete loss anyway if the oil were not re-refined.

The amount of earth required to re-refine oil with different neutralization numbers does not vary over a wide range of quantity. An oil with a neutralization number of 0.2 requires 14 lb. of retrol for 17 gallons of oil, whereas the worst oil that has been refined had a neutralization number of 1.09 mg. KOH/gr. of oil and required 18 lb. of retrol for 17 gallons of oil.

This system of reclaiming insulating oils has a number of distinct advantages over other methods. One of the most important is the fact that a more uniform product is obtained as each batch is treated with a measured amount of adsorbent material per gallon of oil, under exact temperature, pressure and agitating conditions, which makes remixing or reblending of oils unnecessary after this treatment.

Use of mechanical agitation of the adsorbent material with the oil insures perfect contacting, a high rate of heat transfer, heating without chances of burning the oil, and requiring considerably less adsorbent material than other methods.

Our program of re-refining oil as originally set up called for the re-refining of 500,000 gallons of insulating oil over a period of three years. However, this work has greatly been curtailed due to transportation difficulties resulting from the war, and no attempt will be made to follow this schedule for the duration.

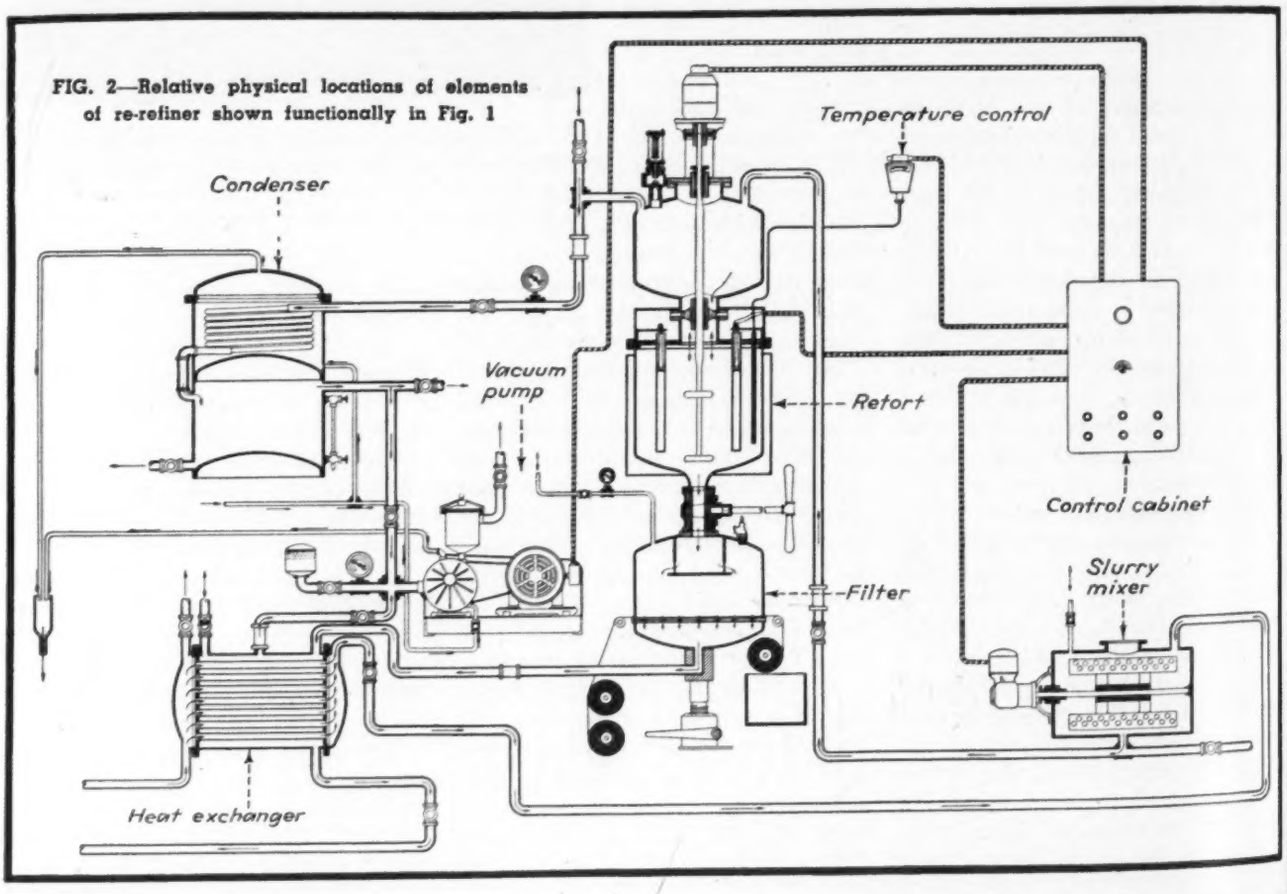


FIG. 2—Relative physical locations of elements of re-refiner shown functionally in Fig. 1

Waste in Electrical Construction in War Plants

Large losses in man-days of labor and in dollars have resulted from incompetent engineering and from failure to incorporate modern practices in designs

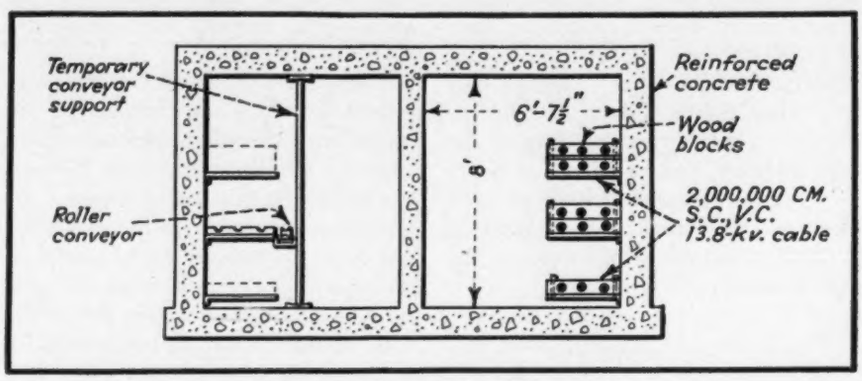
CARROLL H. SHAW, Consulting Engineer, New York City

DURING the past two years the Defense Plant Corporation has contracted for and financed the construction of more than a thousand plants and projects for the prosecution of the war. At some of these plants there have been large wastes of money due to unbalanced construction schedules, changes in schedules, too permanent type of construction, extravagant electrical design, uneconomical plant sites and a clear deficiency of consulting engineering services.

Waste during construction, when reduced to basic factors, is really a waste of labor, either on the site or in the preparation and fabrication of materials that go into the project. It may not be very far from the facts to say that all of the money spent for construction of a project truly represents man-days of labor, except for small percentages to cover interest, taxes and some net profits.

Waste in Wartime

When there is a large amount of unemployed labor available the economic loss due to construction wastes is unimportant to the nation as a whole. But in wartime, when the nation has used up all its reserve of accumulated man-days of labor in the form of stocks of material and equipment, and when there are no longer enough men available to produce the goods that are needed for both war and civilian consumption, then every wasted man-day represents a diminished supply of goods for military and civilian use. It is estimated that a wasted man-day of skilled labor under wartime conditions represents an average loss of $25, including payroll, supervision, administration and personnel activities, and that at least $5 more is lost in associated costs and taxes. At $30 a day, the waste of $100,000 represents the obliteration of 3,333 man-days which are not replaceable.



A MONUMENT to "didn't know how." Double chamber power tunnel, more than 4,000 ft. long and which has a control circuit tunnel paralleling it, was built for a job that could have been done by duct lines at a fraction of the cost

In undertaking the construction of war plants the Defense Plant Corporation appears to have failed to realize that very few engineering concerns, outside of the electric utility field, are qualified to design large electric power installations. In awarding the engineering contracts for the new war plants, Defense Plant Corporation made no provision for the special review of electrical plans. For this they must accept full responsibility because there were available to them many highly competent electrical consulting firms who could have readily shown them more economical and more reliable means for producing the desired results than were adopted by the inexperienced men who were assigned to get out the electrical plans for some of these plants.

Examination of some of the large electrical installations that have been made under the supervision of federal electric power organizations reinforces the conclusion that the socalled "dollar economy" of private industrial plants under peacetime conditions should be enforced to the highest degree on all wartime construction projects, as a means of conserving irreplaceable man-days of labor, even if, as often seems to be the case, money is no object.

Some Instances

It is proposed to describe here a few instances of engineering design that have required unnecessary expenditure of labor and materials and which have resulted in electrical installations that are monuments to incapacity.

One of the largest electrical war

plant installations required that 200,000 kw. be distributed with unusual uniformity to a group of buildings extending in a straight line for nearly a mile, with some auxiliary loads located close by. Incoming supply was over two 230,000-volt transmission lines to feed three 75,000-kva. substations, each containing three 25,000-kva. single-phase transformers with 13,800-volt secondaries.

For this job the designers elected to construct a twin-chamber, reinforced concrete power tunnel 4,300 ft. long, with provision for fifteen 2,000,000-circ.mil, single-conductor, varnished-cambric insulated, 13,800-volt cables in each chamber. The cables are supported on wood blocks which rest on heavy, welded, galvanized steel channel brackets on 29-in. centers, with continuous copper bonding and grounding connections to each bracket. Six cables may be carried by each bracket, and provision is made for two or three brackets at each position. The brackets are supported by bolts inserted in the walls of the tunnel during construction.

A Very Special Job

Each chamber of the tunnel is 6 ft. 7½ in. wide by 8 ft. high, inside, with a 9-in. concrete wall separating two chambers throughout its length. The walls and roof are heavily reinforced with steel, arranged in a special manner to minimize magnetic flux circulation. Excavation for the power tunnel—there is a similar single chamber control tunnel paralleling it—required the removal of at least 100,000 cu. yd. of earth. More than 12,000 cu. yd. of concrete was used in its construction, which was carried on with meticulous accuracy so that the bolt inserts for the brackets would show no misalignment.

The designers had an inhibition against cable splices, so they specified the cable in specific lengths running up to sections over 1,200 ft. long. Cable was shipped on reels that were wider than the clear width in the tunnel between the ends of the brackets on one side and the division wall on the other, so that the reels could not be dropped into the tunnel and the cable unreeled from a dolly. Instead, the contractor purchased 1,800 ft. of gravity roller conveyor for feeding the cable into position above the wood blocks. This conveyor has roller bearing rolls and has to be installed in 8-ft. lengths for each installation of cables. It is supported on 4x4-ft. wood posts erected just for this purpose between the floor and roof of the tunnel. It requires several days to install the conveyor for each position, using a crew of carpenters to erect the posts and mechanics to align and bolt up the conveyor sections. The cable reels were set up at the manholes to feed the cable onto the conveyor in the tunnel below. Portable telephones were installed to assist the foreman to control the installation of cable and its feed-along in the tunnel. The cables were covered with a light application of arc-proofing cement throughout the length of the tunnel.

There are full size access passageways connecting one chamber of the tunnel with the sub-basements of the adjacent buildings and with the outlets to the supply transformers. No provision was made in the design to segregate the two groups of cables in these passageways, although the purpose of the division wall in the tunnel was to isolate one group of cables from the other.

The wood block cable supports were to be kept in vertical alignment on the brackets by means of ⅞-in. Everdur pins dropped into holes at the ends of the block, and then a copper strap was to tie these two pins to the grounding bus; 15,000 lb. of these straps were later consigned to the scrap heap when the shortage of copper became critical. There were 5,200 of the Everdur pins, weighing 8,500 lb.

As compared with this elaborate monstrosity, a standard underground conduit and cable installation would have provided a much better segregation of cables, a much easier means of installing cable sections and replacing them if defects occur, at a cost of less than half that required for the construction and equipment of the twin-chamber tunnel. The conduit system would have consisted of two separate duct banks of from six to twelve ducts each, incased in a concrete envelope. Manholes would be placed at each building for cable connections thereto at about 400-ft. centers. The cable should have been paper insulated, lead covered.

It is estimated that the failure of the designers to follow electric utility practice in this instance resulted in the unnecessary expenditure of more than $400,000, around 14,000 man-days. Since actual data are not available this estimate is intentionally low.

Another undertaking called for an electric power supply to operate pumps for the water system of two war plants and their associated housing projects. Hydro-electric power is generated at the outlet of the lake from which the water is taken at 16,000 volts and is transmitted to the larger war plant at 230,000 volts.

Robin Hood's Barn

The war plant is 14 miles inland from the hydro-electric plant. The water pumping plant is on the lake shore about 6 miles from the power house and is about 10 miles from the war plant. Maximum pumping load is estimated at 6,000 kw.

A reasonable and efficient method of supplying the pump motors would have been to build a 16,000-volt line or two or three circuits from the power house to the pumping stations. As it would have crossed a recreational park, it might have been found reasonably economical to use three three-conductor armored cables laid underwater along the lake shore for a part of the distance. Such an installation could have been made quickly so that permanent electric pumping could start as soon as the pipe was ready.

The adopted design was much different. At the war plant the 230,000-volt supply is stepped down to 13,800 volts for plant use. At one end of this 13,800-volt system the designers located a 10,000-kva. substation, which raises the voltage to 69,000 volts and feeds power back to the pumping plant at the lake over a single-circuit, wood-pole line 10 miles long, across a ridge of mountains and across almost inaccessible gullies. Since the main transmission line and substation at the war plant and the two 10,000-kva. substations for the water pumping line could not be ready for service as soon as the water line, a large installation of gasoline-engine-driven pumps was made at the receiving reservoir and a smaller gasoline engine plant was installed at a temporary intake for the initial water supply. In the permanent elec-

ic installation the intake motors are ed at 4,160 volts over a single-circuit uried cable about 4 miles long, riginating at the 10,000-kva. sub-tation adjacent to the receiving reser-oir and booster pump plant.

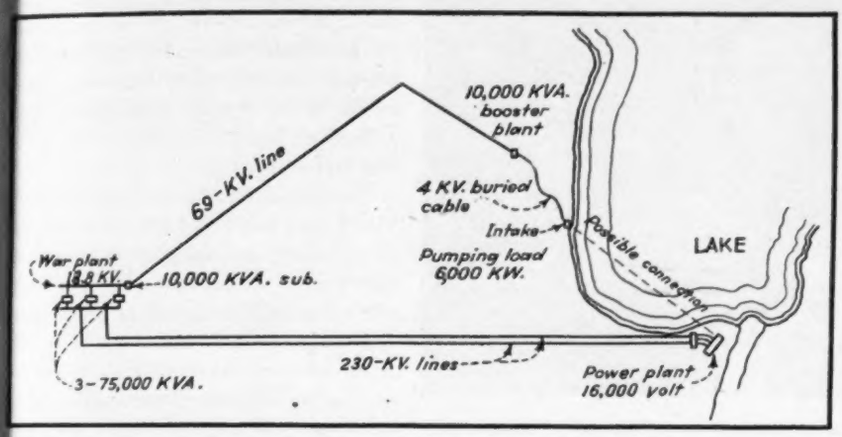
In this installation the power used y the pump motors undergoes four ransformations, when one would be nough; 6,000 kva. of 230,000-volt ransmission line and substation apacity and equipment are rendered seless for direct war plant use and he reliability of supply of power to he pump motors is much lower than ould be provided by the direct in-tallation as outlined.

It is estimated that the extra cost f this design exceeds that of the amp. produced at voltages up to 625. While it is true that 600-volt circuits for electrolytic cell operation were once considered too high for safety, several years of safe and reliable operation at this voltage by the Aluminum Company of America and Dow Chemical Company should have been recognized and accepted, if not improved upon, by the designers of the project under review.

Quantitatively the problem was to operate at least 800 cells continuously, with 10 percent in reserve for repair. To arrive at the size of the individual installations the designers had a range of choices from the modern use of 600 volts per circuit down to the 350-volt per circuit that had been employed in earlier designs of this type of plant before the practicability of 600 volts had been demonstrated. To use 350 volts would require the installation of 80 5,000 amp. rectifiers exclusive of spare units; to adopt exactly 600 volts would reduce this to not over 48 productive rectifiers, and if an increase to 700 volts could be allowed, with a little risk and ingenuity, the number of rectifiers could have been reduced to 40; 350-volt circuits were adopted. There are 20 circuits, two to a building in ten buildings. Eight conversion units plus two reserves were installed, making a total of ten rectifiers or their equivalents in rotating machines in each building.

If the conservative 600 volts had been used it would have required but four rectifiers and one reserve per building in twelve smaller installations, while if 700 volts had been provided it would have taken a total of only 40 rectifiers, plus ten reserves. Since the efficiency of rectifiers increases with higher output voltage, there would have been a substantial gain in conversion efficiency as well as a reduction of the amount of equipment to be manufactured, transported installed and connected.

But the penalty for adopting the less efficient voltage was not limited to having to purchase the equivalent of 100 5,000-amp. rectifiers instead of from 50 to 60, for it developed that no equipment manufacturer would undertake to supply that quantity of units. And to make bad matters worse the orders for the equipment were finally divided among three manufacturers, two of whom furnished two rectifier and two motor-generator installations respectively and one of whom supplied two rectifiers only for each of the ten buildings.



SIX MILES of cable circuits would have avoided the building of 10 miles of 69-kv. line, 4 miles of 4-kv. underground and two 10,000-kva. substations

10 miles of 69,000-volt line plus the cost of the two gasoline-engine-driven pump installations.

A third example of wasteful design involves not only a flagrant disregard for the basic principle of using machines of identical design as far as practicable in an installation requiring many units of the same size and use, but it ignores entirely the recent developments in electrical design that would have reduced the requirements for rectifier equipment by at least 40 percent.

The problem called for the installation of electrical equipment to supply 19,000 amp. of direct current to electrolytic reduction cells arranged in series in such numbers as to absorb the maximum direct current voltage to be developed by the rectifier or conversion equipment.

There has been wide experience in this country in the operation of electrolytic cell circuits carrying 60,000

Much Unnecessary Work

As a result of the adoption of this hodge-podge of both equipment and design, resulting from the adoption of too low a circuit voltage, it became necessary for the designers to prepare detail construction drawings for five different designs of electric plant structures and for five different electric wiring and control installations. There were many hundreds of man-days required to prepare the details for the extra designs, and because the drawings could not be completed simultaneously the contractor and the equipment suppliers had to juggle and adjust their schedules, with a resultant loss of efficiency in construction and delay in its completion.

The direct labor of installing the rectifier units is estimated at not less than 200 man-days per unit. An excess of 40 units represents a waste of 8,000 man-days for this part of the work alone. No attempt has been made to estimate the total waste that resulted from the selection of the 350-volt circuits, but enough has been shown to bring out that not less than 75,000 kw. of electrical conversion equipment had to be manufactured and installed, and now must be manned for operation, needlessly.

Other examples of waste resulting from imperfect electrical designs could be outlined. But the proposition that much waste could have been avoided would seem to be adequately demonstrated by these instances.

Home Service Canvass Gives Customer Service Advice

Bilateral appliance canvass in St. Louis helps customer with appliance service problems and at the same time collects valuable market data

ADVICE of canvass interviewers directs St. Louis housewives to "care-use" classes like this one on laundry equipment

CUSTOMER CALLS by lighting and home service women are continuing in St. Louis, but their character has changed. They are no longer devoted to the lighting and appliance demonstrations of pre-war days. The new emphasis is on service and the new calls are keyed to this theme. In essence they are two-way wartime consultations between customer and home service specialist. Both parties contribute; both parties benefit. Through the calls the company achieves a vital personal contact with its customers and secures valuable data on residential appliances, their age, use and state of repair. The customer in turn gains important information of the wartime care, repair and use of her electrical appliances.

The program was inaugurated by the Union Electric Company of Missouri in July, 1942, and up to January, 1943, had covered 3,141 of the 186,254 residential customers in St. Louis.

While the accompanying table does show the statistical results and findings of calls made up to January 1, figures alone do not tell the story of this canvass. Probably its most valued achievements from the company standpoint have been the customer contacts established and in familiarizing the customer with special company services. Appliances long unused have been brought off the shelves and customers are being told and shown how to go about using them and having them repaired. This not only renders a service to the customer but also gives work to the neighborhood dealer, in his repair shop.

Objectives of the program of home calls spring directly from the multiple wartime needs of residential customers with respect to their appliances and the related interests of the company in the quality of its service.

In the order of importance, then, the calls seek to achieve the following ends: (1) Build a bond of understanding between customer and company; (2) help the customer conserve existing appliances; (3) direct necessary appliance repair work into proper dealer channels; (4) familiarize the customer with the free services of the home service department; (5) collect information for post-war commercial activities.

Residence customers have been divided into two classes for the purpose of the canvass—range customers and non-range customers. Range users were logically assigned to home service women since their activities are more closely associated with electric cookery. Non-range customers, those with only refrigerators and small appliances, were assigned to home-lighting advisers, since, for the period of the war, home-lighting business is not being promoted and recommendations are made only on request.

A report form, shown, is used for each call. Its purpose is to direct the course of the consultation into prescribed channels and hold it there rather than in any way formalize the call into a question bee type of survey. The form also provides for orderly reporting of data.

For each of the listed appliances on the report form topic questions were selected not only to provide the desired statistical information but also to help the interviewer advise the customer. Topic questions are the same for each appliance, and each leads logically to the next. For example, "Is the appliance used regularly?" This answer depends largely on family habits. But if the answer is "No" the next question, "Why is it not used regularly?" usually reveals improper use of the appliance or that it is not operating as the customer believes it

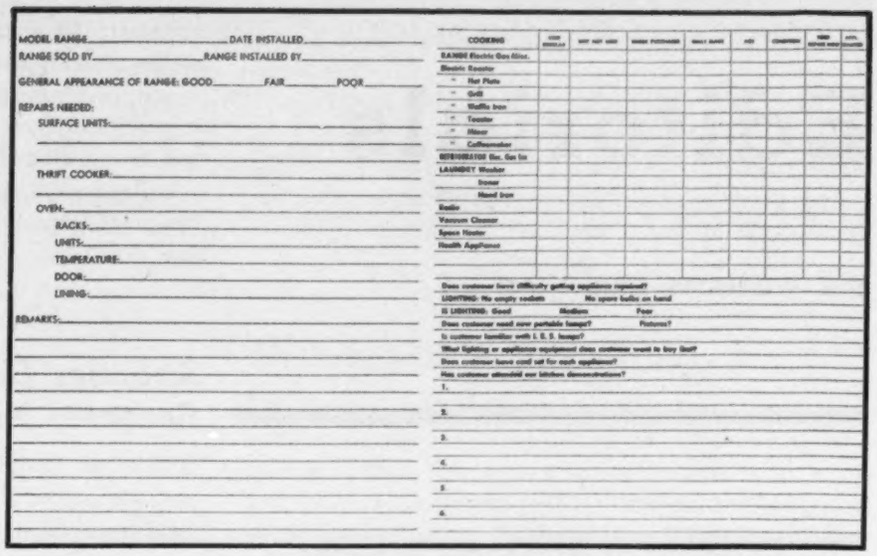
hould. This may be due to inadequate information on how to use or o necessity for repair. Logically the onversation turns to technique of roper use and to the exchange of dvice or the suggestion that the customer attend the company's "Care-Use Classes" given by the home service department. However, if the ppliance is in need of repair, the uestions "Where was it purchased?" nd "What is the make?" help the interviewer suggest the proper repair gency. The company uniformly recommends that appliances be repaired by the dealer who sold them. However, if this is not known, the make of appliance offers a clue to the proper epair agency. Succeeding questions s to age (5, 10, 15 or 20 years), condition (good, fair, poor) and need of mmediate repair were inserted for he information of the company in planning future commercial activities. However, if properly directed by the nterviewer, even these questions can draw the conversation into lines dealing with the desirability of replacing he appliance after the war and introduce the final question: "What new ppliances are wanted?" This question usually revealed definite desires on the part of the customer.

Future Lighting Market

Answers are also sought to several questions relating to the adequacy of customer's present lighting and the future market for home-lighting equipment. These questions reveal such things as the customer's familiarity with I.E.S. lamps, the need for new portable lamps, the supply of spare bulbs on hand, as well as whether the customer has a cord set for all appliances and if she has ever attended a company kitchen demonstration.

The interview regarding the range follows lines similar to that for small appliances. It concerns age, make, appearance, condition and repairs needed. The purpose is to help the customer who hasn't been making full use of her range. In short, to make her "friendly" with her range and what it will do. An effort is made to familiarize the customer with the services of the home service department and of electrical dealers.

If the condition of the range indicates improper use, tactful suggestions are made that will correct the condition. Where necessary an appointment is made for a subsequent two-hour call by a home service woman.


MODEL RANGE _____ DATE INSTALLED _____

RANGE SOLD BY _____ RANGE INSTALLED BY _____

GENERAL APPEARANCE OF RANGE: GOOD _____ FAIR _____ POOR _____

REPAIRS NEEDED:

SURFACE UNITS: _____

THRIFT COOKER: _____

OVEN: _____

RACKS: _____

UNITS: _____

TEMPERATURE: _____

DOOR: _____

LINING: _____

REMARKS: _____

COOKING

RANGE Electric Gas Elec.

Electric Toaster

" Hot Plate

" Grill

" Waffle Iron

" Toaster

" Mixer

" Coffeemaker

LAUNDRY Washer

Ironer

Hand Iron

Radio

Vacuum Cleaner

Space Heater

Health Appliance

Does customer have difficulty getting appliance repaired?

LIGHTING: No empty sockets _____ No spare bulbs on hand _____

IS LIGHTING: Good _____ Medium _____ Poor _____

Does customer need new portable lamps? _____ Fixtures? _____

Is customer familiar with I. E. S. lamps?

What lighting or appliance equipment does customer want to buy first?

Does customer have cord set for each appliance?

Has customer attended our kitchen demonstrations?

1.

2.

3.

4.

5.

6.

CALL FORM for St. Louis appliance canvass guides interviewer in giving service advice to customer

The personalized contact with customers by a company representative with nothing tangible to sell has been a vitally important part of the program. It has humanized the company in the customers' eyes. It has reached and helped the more reticent customers who really need help but never "got around" to ask for it.

Comments, invited at the end of the interview, uniformly show the customer's appreciation of the information given and a new understanding of utility service. For example, one customer told the interviewer that she was "pleased with the company service but had no idea that the home service department continued its interest in its customers to the extent of the interest and activities of the present call."

Appliance and Range Canvass

To January 1, 1943 — Total No. Calls, 3,141

	Used Regularly		Age of Appliance				Condition			Need	Appliance
	Yes	No	5	10	15	20	Poor	Fair	Good	Repairs	Wanted
Electric range	377	1	298	73	4	3	9	47	322	52	.....
Refrigerator Gas	74	.....	56	8	9	1	.....	7	67	.....	3
Refrigerator Electric	2,491	7	1,582	746	144	26	26	383	2,089	61	142
Refrigerator Ice	486	2	212	150	77	49	38	234	216	16	72
Roaster	204	123	279	41	7	.....	7	16	304	12	90
Hot plate	59	67	94	23	5	4	3	10	113	3	2
Grill	109	105	157	49	6	2	5	6	203	4	2
Waffle iron	495	717	731	340	111	30	20	124	1,068	23	53
Toaster	1,986	297	1,546	505	169	63	52	367	1,864	60	151
Mixer	553	153	545	144	15	2	21	35	650	28	109
Coffee maker	552	259	615	117	50	29	33	53	725	43	16
Washer	2,309	61	1,391	654	251	74	63	545	1,762	107	132
Ironer	151	25	107	46	16	7	7	23	146	16	37
Hand iron	3,134	45	2,277	615	193	94	67	584	2,528	113	222
Radio	3,100	85	2,169	732	237	47	118	646	2,421	179	75
Vacuum cleaner	2,023	59	1,042	583	287	176	96	528	1,458	146	267
Space heater	111	85	98	56	22	20	2	27	167	8	7
Health appliance	109	94	150	35	11	7	5	15	183	11	4
Miscellaneous	66	52	72	34	5	7	1	2	115	1	10
Totals	18,389	2,237	13,421	4,951	1,619	641	573	3,652	16,401	883	2,394

Does customer have difficulty getting appliances repaired? Yes, 206; No, 2,929.
Lighting: Customers having empty sockets: Yes, 741; No, 2,394. Customers having spare bulbs on hand: Yes, 1,938; No, 1,197.
Is lighting: Good, 771; Medium, 1,555: Poor, 809.
Does the customer need new portable lamps? Yes, 1,353; No, 1,782. Fixtures? Yes, 831; No, 2,304.
Is the customer familiar with I.E.S. lamps? Yes, 2,308; No, 827.
Does the customer want to buy a particular electric appliance first? Yes, 1,466; No, 1,669.
Does the customer have cord set for each appliance? Yes, 2,966; No, 169.
Has the customer attended our kitchen demonstration? Yes, 474; No, 2,661.

Editorials

S. B. WILLIAMS, *Editor*

The Shadow of Railroad Wrecks

THE first week in September was a record for loss of life in train wrecks. That the accidents all occurred in a week was but a coincidence, nevertheless that coincidence caused more than one person to wonder if perhaps other services that are being hard pushed by the demands of war are also vulnerable.

In the service of electricity it will be noted from a study of the weekly output chart that the actual increase week by week this year over last year of generated kilowatt-hours is greater than ever before. In fact, it would not be surprising that the excess of energy produced this year over the record-breaking 1942 were greater than all the electricity sold in this country during the twenty months it was in the first World War.

Peaks are not becoming burdensome; in fact, the reserve situation this year may even improve on an over-all national basis. The time, however, that generating equipment is in operation is becoming much longer. It is estimated, for instance, that the hours' operation per kilowatt of generating capacity this year will be approximately 4,650, or 500 hours more than the previous high record of 1942. In spite of a near record year for the installation of new capacity, this is by far the largest increase in hours' use in any one year.

The record of generating equipment is such that we do not know how much punishment it can take without overhaul. Certainly, the electrical equipment is almost ageless—provided loads are kept within rating limits. The steam generating equipment, on the other hand, cannot stand an indefinite number of fired hours.

While the parallel between railroad and electric service probably does not go beyond the greater hours of use of equipment, the railroad failures did lend emphasis to the need for every measure possible to help prevent outages. The method described in this issue is one that has been used successfully for a period of five years.

Interestingly enough, the newspaper reaction, which in a way may be looked on as the public's opinion, was not to blame the railroads but the war. Would they be as generous under like circumstances with the electric utilities? Or would they be persuaded by the Secretary of the Interior and others of the official family that this would never have happened if their advice for larger expenditures for capacity, both government and private, had been followed?

Regardless of what happens to outside plant, generating plant inspection and maintenance is more important now than ever. Check, double check and check again.

Stronger Depreciation Reserves Needed

ONE of the healthiest conditions for any company in the post-war period is a strong depreciation reserve. Yet the 1942 financial statistics of 204 holding company subsidiaries recently reported by SEC show an average depreciation reserve of but 14.98 percent of property. Nor does there seem to be any norm, the company figures showing wide variations from the average—the high is 48.98 percent and the low less than one percent. Less than a quarter of these companies have a reserve in excess of 20 percent of property and 15 percent have less than a 10 percent reserve.

High reserves are a cushion against a readjustment period when one class of business falls off more rapidly than another can expand. They are also sources of ready capital at low rates, as well as excellent insurance against property loss from wear and tear under the excessive strain of overloads much of which has been experienced during the war but about which little is known now. And there is always the possibility of more rapid obsolescence brought about by post-war design. In several fields improved design is going to obsolete much of our present equipment and practice. Have we any reason to believe that progress will by-pass the utility industry?

There has been considerable regulatory encouragement for higher reserves and there is reason to believe that many companies are setting larger amounts aside for depreciation. The figures, however, would indicate that there is still room for improvement.

Coal Storage Reversal

FROM a peak of nearly four-months supply of coal in storage at the first of the year, the utilities are down now to under three months, with two months or a little over indicated as the probable minimum goal. All areas except Ohio and Lower Missouri Valley, where stocks were close to 60 days, showed decreases during the month of July, the latest for which data are available. Also in the latest regulation governing shipments by producers in district eight, the 25-percent restriction applied only to orders from utilities having more than a 60-day supply on hand.

Generally speaking, a 60-day supply of coal even at this time of the year would not be considered unsafe, but

with the uncertainties of transportation in the winter augmented by the strain of war and with the uncertainties of continued coal production it would be most unfortunate if fuel supplies were permitted to go below the 60-day level.

Four-months supply was, of course, warranted on only one basis—cooperation with transportation and to be ready in case of trouble. The former power branch of WPB saw the advisability of fuel stocking beyond current needs as a means of helping the railroads out of possible difficulties last winter. As a means of cooperation, the utilities went to considerable expense to double up on the coal storage. It meant extra equipment, idle money, extra cost of preparing storage piles and additional storage space. Now, a year later the picture has changed because of coal production difficulties and the utilities are required to backtrack.

This is all in the national interest and the utilities as usual will respond quickly. In fact they will be down to the 60-70-day area, at the rate they are going, long before the winter peak.

Material for Three Quarters of a Million Gas Ranges

WHY is it that WPB allows in its amended L-23-c order on domestic cooking appliances a production of nearly three-quarters of a million gas ranges and excludes electric ranges? The order allows up to 40 percent of the base period which, if not the best year, wasn't far from it.

Is a gas range any more conservative as to materials for its manufacture or its installation? Is gas more readily available than electricity? Is any more transportation of fuel saved, especially now that electric companies are reducing their fuel supplies?

Time after time gas has been given preference, so much so in fact that it must be admitted that the gas people are much more alive to their opportunities than the electrical people. There are some electrical interests that are doing their best to get an even break for electricity, but their efforts are pitted against those of an organized industry, an industry that works together.

Last winter the gas producers had to appeal to the public to reduce consumption because there wasn't enough gas to go around. No such situation exists with regards to electricity.

Distributed electric ranges, it has been demonstrated, because of diversity, do not add greatly to the peak and therefore do not put much of an extra burden on distribution or generation. Surely the extra copper to bring in service cannot be said to be more extravagant of critical materials than the gas piping service, for electric service has to be made anyway for lighting.

If it were only supply for the duration it would not be worth discussing, but each one of the homes that gets a new range is a customer for that service long after the war.

The reasons for preference for electric equipment are fully as cogent as gas, while the conservation features if anything are greater. Why then does gas get the call? Would it, if the electrical industry was as well organized in telling its story to the right people in Washington?

Mistakes Now Appearing

MUCH can be forgiven the man who has a job to do in a hurry, particularly when the hurry is the terrible compulsion of war. He does what he can with what he has and his credo is the oft-quoted, "The difficult things can be done right away; the impossible things take a little longer."

When a nation turns in that spirit from production for peace to production for war mistakes are inevitable. And when mistakes are readily recognizable as resulting from the need to get done today things that should have been done yesterday, they can and will be forgiven.

But when mistakes apparently are made because of ignorance, incompetence or worse, then it is necessary to examine them rigorously and fix the responsibility for them.

The hurry compulsion of war is now shifting, already is largely shifted, from preparation to production. And as the emphasis shifts the mistakes made in preparation are coming to light. Engineers are now finding time to look at what engineers have built. By and large, they can look at their work and say that it is good. But some things they see are not good and it will take more than red-faced expostulation to explain them.

Possibly there were reasons why it was necessary to build nearly a mile of costly double tunnel to distribute electricity in a large war production plant in preference to standard underground cable construction. Possibly there were reasons why the direct-current voltage for a large electrolytic metal reduction operation was fixed at 350 volts when much more economical potentials up to 600 volts and higher had been used for the same kind of production for many years in this country. Possibly there were reasons for transmitting 6,000 kilowatts of power 14 miles at 220,000 volts and then sending it back at 69,000 volts by another route to a point six miles from where the power is generated.

But no explaining reasons were seen by the observer who reports these three instances of apparently screwball engineering in this issue of ELECTRICAL WORLD. It is one of the great beauties of good engineering that the structure or the method justifies its design. Its reasons for being as it is are built into it, plainly to be seen by the discerning eye. It seems on their faces that in these three instances, and probably in others that await future disclosure, something other than reason was the determining factor.

Washington Comment

By R. N. LARKIN, Washington Correspondent

Priorities Delays Tighten Power Situation

WITH about two-thirds of the 7,500,000-kw. 1943 power program on the line, the Office of War Utilities is in excellent position to reiterate its favorite statement, that there has been, is and will be no shortage of electric power for essential needs.

Even the fact that the last third of the program, some 70 stations, is behind schedule has not proved that OWU's formula for authorizing new capacity and calculating available reserves was wrong.

By way of taking no chances, OWU has warned WPB that conflict between programs for the same items —forgings, castings, boilers, fans and valves—has put the remaining stations about 4.5 months behind their original schedule. That much delay can be accommodated without difficulty, OWU warns, largely because many new war power loads have been somewhat delayed. Further delay could throw various industrial sections open to trouble in the event of major outages. As a result, WPB is considering just how it can best give improved right of way to protect some 15 strategic projects against further delays and how it can assure that the remainder will not slip dangerously.

Power Held Back

When the power program was cut in 1942, the remaining 7,500,000-kw. were scheduled on very nominal ratings, usually A-2. This was done deliberately, for WPB's power men knew as well as anyone that Liberty ships, tanks, aircraft and new manufacturing facilities were vital. They did not want the power program obstructing these programs.

About last February, however, when the struggle for predominance between rubber, high-octane gasoline, escort vessels, aluminum fabrication and cargo ships was on the front pages, the power program was seriously threatened by the inflation of the priorities system which went along with over-riding directives and urgency ratings. So the power program was upped to an AA-2X rating, still well below the top priorities. It didn't take too long to find out that an AA-2X is to an over-riding directive as an A-2 is to an AA-1—not so good—and the slippage which had only recently begun was not checked by the higher ratings.

Factory Manpower Difficulty

The power program was based on the twin factors of capacity and time. Units were scheduled to be in place and operating in time to meet the loads for which they were ordered. Thus, in OWU, there was built up an informal "date-urgency" schedule to determine those projects for which it would make the strongest appeal to scheduling agencies. This helped the rush items on the power program, but with the whole power program suffering under the impact of materiel programs, the slippage was accentuated for those projects which were not scheduled for immediate installation.

With the materials and components situation largely under control by mid-1943 and the greater part of the power program out of the way, the sailing looked smooth. Then a new bottleneck — factory manpower — arose to plague the last third of the program, already behind schedule. Effects of the new bottleneck were seen quickly. In late August, incomplete power projects averaged 3.9 months behind schedule. By mid-September, they averaged 4.5 months late. This situation led to the appeal to WPB.

OWU contemplated from the beginning that its emergency reserves were to be found in the non-essential civilian uses of power. Wherever trouble might arise, caused by "quickie" loads, major outages or the development of power loads before development of power capacity to meet them, there was known to be sufficient power available to meet it through interconnections and through L-94 curtailment of non-essential civilian uses. On this basis, operating reserves were deliberately kept low. Insistence of other claimant agencies, notably the armed services, that non-essential uses be cut off and the capacity saved thereby devoted to war loads, thus saving new plants, was denied by OWU on the basis that these non-essential uses provided the margin of safety necessary for the whole program. The immediate use of these reserves for war loads, OWU argued, while creating some temporarily idle capacity, would not allow further curtailment of the power program since the potential reserves available in non-essential uses had already been included in the power planning.

Between now and the end of the year, the power situation will be tighter than could be wished in several areas where reserves have been temporarily infringed by the pressure of other programs to the point that a major outage could force curtailment. The situation is no worse than that, despite increasing babble about a power shortage.

Bringing in the Reserves

Self-help by the industry, public and private, has been of great value in tiding the power program over the period of delayed capacity. Operators are throwing in their dwindling stocks of coal to hold hydro storage capacity at top levels as protection against unscheduled outages or further production delays. Machines and lines are being loaded beyond limits ordinarily considered prudent. Small and old high-cost plants, normally held for major emergencies, are going into operation. Scheduled maintenance is being postponed. Day-to-day cooperation is intimate between systems a thousand miles apart. These self-help activities, as well as many permanent coordination programs, have in numerous instances called for power to flow through intrastate systems. The Federal Power Commission has taken prompt action in each case to eliminate any possible hold-up which might result from regulations designed for peacetime operations.

NEWS OF THE WEEK

Utility Problems Face Reconvened Congress

Calendar includes investigation of REA, McClellan measure on Arkansas and White River dams, Columbia River development plans, McFarland resolution on federal power projects and others

Washington's appointive hierarchy kept a weather eye on Congress as it reconvened this week to determine whether its two-month trip back to the voters had modified or intensified the truculence which last Spring cost the New Deal control over the legislative branch for the first time in ten years.

While it will have such time and interest-consuming matters as a tax bill, the drafting of fathers, possible amendment of the war contract renegotiation law and possible discussion of national foreign policy to deal with, the legislative scene will not be entirely devoid of activity concerning the electric power industry.

REA Investigation

Most Congressional activity related to the industry may center around the investigation by the Senate Agriculture Committee of the Rural Electrification Administration to determine whether political groups have been organized to influence the organization (ELECTRICAL WORLD, July 10, 1943, page 70). Committee officials are gathering exhibits and other data on which the investigation will be based. Public hearings will await completion of this task. A committee spokesman indicated that while the committee is a busy one, there is little possibility that the investigation will be sidetracked by other work.

Any move to transfer REA to the Interior Department presumably will await completion of the hearings, since one of the questions which will be considered is whether REA should be returned to its original status of an independent agency.

Unconfirmed reports in Washington, which ring more true than most, state that an order for the transfer has been submitted to the President but has been held up to forestall charges that the matter was rushed through to avoid a Congressional inquiry. The plan reportedly was prepared by a White House assistant detailed to investigate the internal struggle which has been raging in REA since Administrator Harry Slattery broke with the National Rural Electric Cooperative Association over the matter of co-op loans to two insurance companies established by NRECA. (ELECTRICAL WORLD, July 10, 1943, page 66).

COPPERWELD "E"—The Glassport Division of Copperweld Steel Co., Glassport, Pa., was awarded the Army-Navy "E" pennant recently. In the photo, S. E. Bramer, left, president of Copperweld, accepts the award for the company; Stephen Pollier, center, president of CIO Local 1407, accepts on behalf of the employees; and Col. Will V. Parker, director of the plant engineering agency, U. S. Army Signal Corps, presents the pennant

McClellan's Bill

At least one new bill of direct importance to the industry will be introduced in about another week by Sen. John L. McClellan, Arkansas Democrat. McClellan is completing a bill to coordinate the erection of all dams which have been or will be authorized on the Arkansas and White Rivers.

Tenets of the McClellan philosophy are that no new and separate agency should be established to do the job; that flood control and the development of waterways shall be the primary consideration, with the development of power, while encouraged wherever feasible, distinctly secondary. McClellan hopes to draw up a bill which will establish a pattern for the development of other river valleys. He would lay down rules by which power would be marketed, giving preference in its sale first to the federal government, second to REA co-ops, third to municipal systems and fourth to other prospective purchasers, and turn the marketing job over to the Reclamation Bureau. Dams would be designed for flood control first, power second, and would be built and operated by the Army Engineers. McClellan emphasized that he did not want to establish another Tennessee Valley Authority and that he did not want a vast system of power dams to be

administered by some agency interested only in power. His objections to the TVA principle were based not on TVA's record but on the facts that this principle would create a new agency to do a job for which other agencies already exist and that the underlying philosophy of TVA places power ahead of flood control.

The executive committee of the National Association of Railroad and Utilities Commissioners met Monday at Chicago to consider, among other things, a bill redefining the jurisdiction of the Federal Power Commission. When the bill will be introduced is not known.

Columbia Investigation

Other power subjects on the Congressional schedule include an investigation of federal hydroelectric projects, particularly those in Arizona, by a subcommittee of the Senate Interstate Commerce Committee, acting under a resolution sponsored by Sen. Ernest W. McFarland, Arizona Democrat, and the investigation of Columbia River development plans by a House committee headed by Rep. Compton I. White, Idaho Democrat. The White investigation has been going on for a month in Northwestern cities and probably will continue briefly here. The McFarland investigation has not begun.

Rep. John M. Coffee, Washington Democrat, will press anew for approval of his resolution for an investigation of U. S. participation in the financing of the Shipshaw power development in Canada.

An Interior Department deficiency appropriation bill which will determine finally the ownership of the Shasta-Oroville, Cal., transmission line now being erected by the Interior Department may be expected reasonably soon. Sen. Carl Hayden, Arizona Democrat, promised before adjournment that Congress would get a chance to vote on the principle of Interior Department ownership and operation of high-tension transmission lines. The deficiency bill will attempt to restore to Interior a $1,500,000 item slashed from its appropriation bill earlier this year by House members who opposed Interior's construction of the line (ELECTRICAL WORLD, July 17, 1943, page 6).

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50,000 Kw. Generator Goes in at Cleveland

Some time this week the new 50,000-kw. generator at the Avon plant of the Cleveland Electric Illuminating Co. will go into service, bringing the total generating capacity of the company to 800,000 kw.

Completion of the Avon plant generator marks the third unit to be installed in the program planned in 1938. The first two went into the Lake Shore plant.

The company is also completing a 66,000-volt underground tie-line between its Lake Shore plant and Newburgh substation.

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Dr. Smith Succeeds Clyde Seavey at FPC

President Roosevelt last Tuesday nominated Dr. Nelson Lee Smith of Hopkinton, N. H., as a member of the Federal Power Commission to replace the late Clyde L. Seavey (ELECTRICAL WORLD, August 14, page 17). Smith's name was sent to the Senate for confirmation as Congress reconvened after its first recess since the war started.

Harris & Ewing

Dr. Nelson Lee Smith

Dr. Smith came to Washington in 1941 as chairman of the board of Transportation and Research, an independent agency established under the Transportation Act of 1940. Previously, he had been a member of the New Hampshire Public Service Commission since 1933 and its chairman from 1934 until 1941.

A graduate of Dartmouth College in 1921, Dr. Smith taught economics at Dartmouth between that time and his appointment to the New Hampshire commission, except for two years spent at the University of Michigan when he earned a doctorate. He is 44 years old, married, and father of two children. Politically, he is registered as an independent.

Smith is considered generally to be a conservative, possessed of a "mild liberal" stripe. His background is reasonably similar to that of the late Commissioner Seavey, who also was a state commissioner before joining FPC. Smith's long experience with the National Association of Railroad and Utilities Commissioners, of which he was president several years ago, indicates that he will carry considerable respect for state regulatory bodies into his new job.

On the basis of his experience and background, Washington observers predicted that Smith would not gravitate toward the Olds-Scott faction of the commission, although there was no firm belief that he would tend as strongly toward the Manly-Draper faction as did the late Commissioner Seavey.

It was pointed out in several quarters that Smith never went on record strongly in favor of public ownership when he had several opportunities to do so during his presidency of the NARUC.

If confirmed, Smith will serve out Seavey's unexpired term, which extends until June 23, 1945. Salary is $10,000 yearly.

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United Corp To Obey SEC Order

In a letter sent to stockholders of United Corp. this week, William M. Hickey, president, declared that the management of the holding company had decided not to seek a review of the recent (August 14) decision of the Securities and Exchange Commission calling for simplification and recapitalization of the corporation under the provisions of the Holding Company Act. First step in complying with the commission order, it was indicated, would be a proposal for exchange of some of the securities of the statutory subsidiaries for outstanding shares of the corporation's preference stock.

The SEC opinion and order had disapproved the corporation's voluntary plan to reduce its holdings in utility companies to less than 10 percent, and directed the holding company to reclassify its present preferred and common stock into a single class of stock and go out of business as a holding company. The commission pointed out that United Corp. might submit a plan to continue in existence as an investment company.

"Accordingly," Mr. Hickey's letter said, "the board of directors is now preparing further plans for compliance with the Holding Company Act, consistent with the commission's order.

Bureau of Reclamation Divided Into Six Areas

Decentralization plan announced by Interior Secretary Ickes is aimed at closer integration of area's power, irrigation problems — Administrative branches also reorganized — Regional directors appointed

Decentralization of the Bureau of Reclamation "to assure full utilization of the land and water resources of the West to meet war and post-war requirements," was announced this week by Secretary of the Interior Harold L. Ickes. The reorganization plan, developed under former commissioner John C. Page, and presented to the Secretary by Harry W. Bashore, the present commissioner, establishes six major field offices to be headed by regional directors in various areas.

Administrative Branches

In addition, the reorganization plan establishes four branches, all located at Denver, under the supervision of the commissioner. These include the branch of design and construction, headed by Sinclair O. Harper; the branch of project investigations, headed by Erdman B. Debler; the branch of operations and maintenance, under John S. Moore and the branch of fiscal and administrative management, directed by William F. Kubach.

"The increasing number of interrelated and complex problems arising from the construction and operation of the many Bureau of Reclamation projects for irrigation, power and related purposes," Secretary Ickes said, "makes it imperative at this time, in the interest of maximum efficiency, to establish area offices to coordinate the organization's activities in each of the six areas. The plan will bring the Bureau in closer touch with the people affected by its functions. It will provide for a more thorough understanding of area problems and of the needs and potentialities of each area than has heretofore been possible through the Washington, D. C., headquarters and the Denver engineering office. Close coordination of bureau operations and a full consideration of local expression, essential in meeting the Bureau's wartime responsibilities and in the preparation for post-war needs will be realized."

Regional directors under the new setup, while under the supervision of the Commissioner of Reclamation, will be given extensive latitude for independent action, the announcement said. They will carry out power development and marketing programs, including the negotiation of power sales contracts in accordance with departmental policy established by the Secretary through the Power Division, and will negotiate construction repayment contracts with water users. Under their jurisdiction, but subject to the technical control of the functional branch heads, will be the execution of investigative programs to determine the economic and engineering feasibility of proposed projects, and the supervision of the operation and maintenance of completed projects. They will also coordinate construction projects with other Bureau operations in their regions.

S. O. HARPER heads Bureau design and construction branch

The Six Regions

The boundaries of each of the six regional field areas were described by Commissioner Bashore, together with the names of the six regional directors appointed. There were as follows:

REGION No. 1. Headquarters: Boise, Idaho.
State of Washington; Oregon, including that part of the Klamath Project in California; Idaho, excluding the Bear River Basin; and the Snake River Basin in Wyoming.
Director: Frank A. Banks (construction engineer in charge of the Columbia Basin Project, Grand Coulee, Washington).
Assistant director: R. J. Newell (construction engineer in charge of the Boise (Idaho) and Owyhee (Oregon-Idaho) projects.

REGION No. 2. Headquarters: Sacramento, California.
State of California, excluding the Klamath Project for the time being, excluding the watershed of the Lake Tahoe area, and excluding the San Diego and Colorado River projects.
Director: Charles E. Carey (consulting engineer for the Bureau and former Budget Examiner, Bureau of the Budget).
Assistant director: Robert S. Calland (district engineer of the Central Valley Project, California).

REGION No. 3. Headquarters: Boulder City, Nevada.
State of Arizona; the San Diego project in California; and the Colorado River projects in California, Nevada, and New Mexico.
Director: Ernest A. Moritz (director of power, Boulder Canyon project, Arizona-Nevada).
Assistant director: Leo J. Foster (construction engineer, All-American Canal and Gila projects, Arizona-California).

REGION No. 4. Headquarters: Salt Lake City, Utah.
State of Nevada, excluding the Colorado River projects therein; the Lake Tahoe area watershed in California; Utah; the Bear River Basin in Idaho and Wyoming; and the Colorado River Basin in Wyoming and Colorado, excluding the Colorado-Big Thompson and the Blue River-South Platte projects.
Director: Ernest O. Larson (construction engineer in charge of the Provo River project, Utah).

REGION No. 5. Headquarters: Amarillo, Texas.
States of Colorado and New Mexico, excluding all of the Colorado River projects, except the Colorado-Big Thompson and the Blue River-South Platte projects; Texas, Oklahoma; and the Arkansas River Basin in Kansas.
Director: Wesley R. Nelson (chief, engineering division, Commissioner's Office, Washington, D. C.)

REGION No. 6. Headquarters: Billings, Montana.
States of Montana, North Dakota and South Dakota; Wyoming, excluding the Snake River Basin, the Bear River Basin, and the Green River Basin; Nebraska; and Kansas, excluding the Arkansas River Basin.
Director: Harold D. Comstock (superintendent of the Riverton Project, Wyoming).
Assistant director: William G. Sloan (senior engineer, Bureau of Reclamation).

Tacoma Okays Nisqually Cost

Tacoma city council last week gave unanimous approval of increased costs of the second Nisqually power project, which soared from the original $11 million to $19,650,000 in the May estimate, which increased the transmission line and related phases.

Cut Coal Shipments For Energy Production

New regulation announced by Ickes restricts to 75 percent of current monthly requirements shipments to purchasers buying for power production, whose stocks total over 60 days supply

Two regulations implementing Solid Fuels Order No. 4, which requires that producers of bituminous coal in the Appalachian region fill commitments for metallurgical coal and for the Great Lakes trade before filling other orders (ELECTRICAL WORLD, September 4, page 87) were issued recently by Solid Fuels Administrator Harold L. Ickes.

Cut Coal Shipments

Coal producers in district eight, (southern West Virginia, eastern Kentucky and parts of Virginia and Tennessee) have been ordered by Amendment 1 to Solid Fuels Order No. 4 to restrict to 75 percent of current monthly requirements all shipments to purchasers buying coal for generation of electricity whose stocks on hand total more than 60 days supply. The percentage may be modified by the Administrator.

The order provides some possibility of increased coal shipments over the allowed 75 percent in that excess sizes unsold after all other orders have been filled may be applied to any orders only partially filled unless specific directions as to their sale are issued by the Administrator.

Second Regulation

In another regulation, implementing the above requirement as well as SF Order No. 4, carload lot shipments of bituminous coal by producers in the Appalachian region are made conditional on a written order or confirmation which contains detailed information about the buyer's fuel stocks. The regulation, designated SF Order No. 5, provides specifically that coal may be shipped on any order only when the order gives the following information:

1. Average number of days supply of coal held by the plant for which the order is issued.

2. Current monthly consumption requirements of the ordering plant.

3. Total of bituminous tonnage ordered from all other suppliers for delivery during the period in which the present order is to be filled.

Meanwhile, Ickes announced that stocks in storage on August 1 had decreased by 312,000 tons from the July 1 total, and urged users to conserve wherever possible. His statement showed electric utility stocks to have decreased 5.3 percent during July, leaving the average day's supply on August 1 at 89, a drop of five from the July 1 level.

July Consumption Up

Electric utility consumption during July was 7.6 percent above that for June, Ickes noted, and average daily consumption was 4.1 percent greater than that during June.

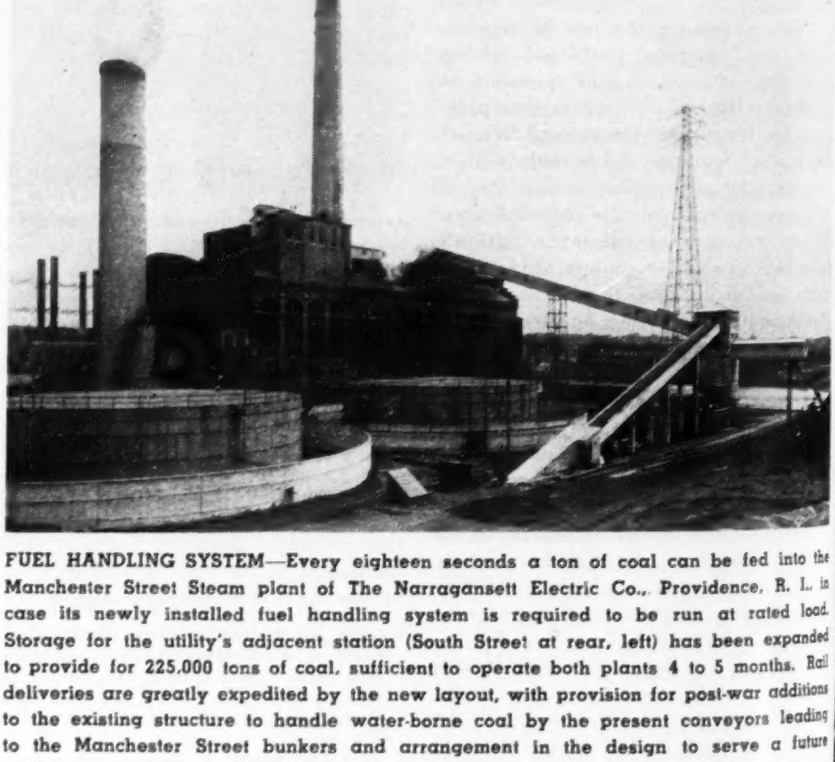
Average days' supply on hand August 1 was 108 for New England; 71 for Middle Atlantic states; 68 for Ohio; 155 for Michigan; 92 for Illinois-Indiana; 66 for the lower Missouri Valley; 171 for the Lake Dock territory; 103 for the Southwest; 84 for the Southwest, Mountain and Pacific and 89 for all regions.

Hydro Project Gets Federal License

Federal Power Commission has announced its order authorizing the issuance of a federal license to the Western Massachusetts Electric Co., Greenfield, Mass., for the Turners Falls hydro-electric development on the Connecticut River in Massachusetts.

The project includes two power houses, with an installed capacity of about 8,770 hp. and 75,000 hp. respectively, and other facilities. A joint application for the license was filed on July 27, 1942, by Turners Falls Power & Electric Co. and the Western Massachusetts company in compliance with the commission's order of July 21, 1942, which directed that the application be submitted by July 31 as a condition to granting of another application filed by the Western Massachusetts, Turners Falls, United Electric Light and Pittsfield Electric companies for approval of their merger and consolidation.

License is to be issued for a period effective January 1, 1938, and terminating June 30, 1970, and shall specify a rate of return of 6 percent per annum on the net investment after the first 20 years of operation of the project under the license, that is, after December 31, 1957.



FUEL HANDLING SYSTEM—Every eighteen seconds a ton of coal can be fed into the Manchester Street Steam plant of The Narragansett Electric Co., Providence, R. I., in case its newly installed fuel handling system is required to be run at rated load. Storage for the utility's adjacent station (South Street at rear, left) has been expanded to provide for 225,000 tons of coal, sufficient to operate both plants 4 to 5 months. Rail deliveries are greatly expedited by the new layout, with provision for post-war additions to the existing structure to handle water-borne coal by the present conveyors leading to the Manchester Street bunkers and arrangement in the design to serve a future boiler and generator unit adjacent to the present 1,200-psi boiler. Both plants are important factors in the operation of the New England Power System

Conservation Drive Starts on Schedule

Overshadowed by the Third War Loan Drive, the Government's conservation campaign got off on schedule September 15 with electric, gas, water, coal, transportation, communications and oil industries pledged to an intensive drive aimed at checking wasteful uses of these commodities.

Local campaigns opened after chiefs of the three federal agencies controlling these industries urged public cooperation during a nationwide radio broadcast last Monday night. WPB Chairman Donald Nelson, Interior Secretary Harold L. Ickes and Director Joseph B. Eastman of the Office of Defense Transportation outlined the whys and wherefores on the broadcast.

Early government publicity on the drive was minimized by the space devoted to the Third War Loan and by the capitulation of Italy, but the latter development added weight to one of the reasons for the drive—the fact that as enemy nations are forced out of the fighting, resources of the Allies will be needed for their rehabilitation. Coal particularly will be needed in Italy, which has none of its own. With England's coal already allocated to home war industries and to North Africa, it is generally expected that most if not all of the coal shipped to Italy will have to come from the United States.

Government men operating the campaign are pushing the organization locally of groups representing all the participating industries, through which local activity will be channeled and coordinated. When these organizations have been established and reporting systems through which campaign achievements can be collected and correlated are ready, the mechanics of the campaign will largely have been completed.

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OPA Granted Stay On Washington Rate Case

The District of Columbia Court of Appeals has granted a further stay of the mandate to the Office of Price Administration, extending until October 7 the time in which OPA can file with the Supreme Court for a writ of certiorari asking review of the Appeal Court's decision upholding the District Public Utilities Commission's award of a $201,000 annual rate increase to the Washington Gas Light Co.

The rate increase, (ELECTRICAL WORLD, September 11, 1943, page 7) was granted for the year September 1, 1942, to August 31, 1943. If the writ of certiorari is granted, the high court will get its first opportunity to pass on the extent of OPA's powers over utility rates under the Second Price Control Act of October, 1942.

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Southwest Power Shortage Asserted

Wright sees "strict rationing" necessary

The Southwest faces "strict rationing of power" unless power production is increased soon, Douglas G. Wright, acting administrator of the newly created Southwestern Power Administration, told an Arkansas-Oklahoma flood control conference at Fort Smith, Ark., recently. "The public has been misled into believing there is a surplus of power in the Southwest," he said. "The opposite is true and the entire section faces strict rationing of power by the War Production Board unless more production is obtained."

Mr. Wright declared further that there had been some "misconceptions" about operation of the Pensacola Dam in Oklahoma during the record-breaking flood of last May, and asserted that the flood was too great for the dam to hold.

"More than 4,085,000 acre-feet of water passed through the dam in 13 days and the flood storage space of the dam was only 9,000,000 acre-feet," he said. "Even if the power pool of the dam had been limited to 735 feet as planned originally, and additional water storage provided, little of the top could have been taken off."

The conference authorized the Arkansas Flood Control Commission to send a resolution to WPB urging immediate construction of the Fort Gibson Dam on Grand River, in Oklahoma. The war agency had previously disapproved a request for the construction. Col. F. J. Wilson, Tulsa district engineer, told the assembly that his office is prepared to start construction on Fort Gibson Dam the moment authorization is announced.

Chairman A. B. Hill of the Arkansas Utilities Commission, supported by a report of the Southwest Power Pool, took issue with Mr. Wright on the alleged power shortage, and denied that Southwestern states face a curtailment of electric consumption. Drought conditions had affected operations to some extent, Mr. Hill said, "but I can say without reservation there is no necessity for curtailment of power."

Radio Broadcast Lauds Power Industry

A fast-moving dramatization of electrical development in this country and the power industry's contribution to the war effort featured the September 11 broadcast of the "Little Blue Playhouse," a regular Saturday morning sustaining program of the Blue Network. The script was entitled "Volts Times Amperes Equals Watts!" and was prepared by Ira Marion and directed by Madge Tucker.

Beginning with brief sketches of electrical pioneers—Michael Faraday, Benjamin Franklin, Sir Humphrey Davey, Thomas A. Edison, Z. T. Gramme and George Westinghouse—human interest episodes documented the broadcast throughout. Kilowatt-hours, load curves and other technical aspects of the power industry were presented in terms which anyone could understand—a method usually employed in the series due to the fact that a large part of the audience is made up of young persons.

Hail War Effort

More than half the program was devoted to the utilities' war effort and emphasis was laid on the vital role of the industry as a basis of all war production activity. Hurried development of emergency war loads and similar activities were described as were striking instances of the vital role of interconnected utility systems in providing continuous adequate service. The broadcast concluded with a brief sketch of post-war production and the role electric power will play, finishing with the words, "And electric power will be in there pitching for you and all the generations to come after you. Power is on the job for America!"

•

Ninth Unit Turns At Bonneville Dam

Major-General Thomas M. Robbins, assistant to the chief of Engineers at Washington, who as North Pacific division engineer directed the planning and construction of Bonneville Dam, was present September 3 when the ninth main generator was turned over for the first time. The new unit has a rated capacity of 54,000 kw. and was to go through a ten-day series of tests before being placed in service. The planned power development at Bonneville calls for 518,400 kw. and the tenth and last unit is scheduled for completion December 1 this year.

Standard Frequency Broadcast Improved

The standard frequency broadcast service of the National Bureau of Standards radio station WWV, at Beltsville, Md., has been improved and extended, according to a recent announcement. Improvements include the building of a new transmitting station, the installation of ten-kilowatt radio transmitters and the addition of more frequencies and voice announcements.

The services of the station now include: (1) Standard radio frequencies, (2) standard time intervals accurately synchronized with basic time signals, (3) standard audio frequencies and (4) standard musical pitch, 440 cycles per second, corresponding to A above middle C.

The service is continuous at all times day and night. The standard radio frequencies are:

5 megacycles (= 5,000 kilocycles = 5,000,000 cycles) per second, broadcast continuously.

10 megacycles (= 10,000 kilocycles = 10,000,000 cycles) per second, broadcast continuously.

15 megacycles (=15,000 kilocycles = 15,000,000 cycles) per second, broadcast continuously in the daytime only (that is, day at Washington, D. C.).

There is a pulse every second, heard as a faint tick each second when one is listening to the broadcast. The pulses last 0.005 seconds; they may be used for accurate time signals, and their one-second spacing provides an accurate time interval for purposes of physical measurements.

The accuracy of all the frequencies, radio and audio, as transmitted, is better than a part in 10,000,000. The time interval marked by the pulse every second is accurate to 0.00001 second. The one-minute, four-minute, and five-minute intervals, synchronized with the seconds pulses and marked by the beginning and ending of the periods when the audio frequencies are off, are accurate to a part in 10,000,000.

Information on how to receive and utilize the service is given in the Bureau's letter circular, "Methods of Using Standard Frequency Broadcasts by Radio," obtainable on request.

•

Energy Requirements Up

Electric energy requirements of the principal public utility systems of the country during July totaled 18,235,656,000 kw.-hr., a gain of 17.1 percent over the same month last year, the Federal Power Commission has announced. Utility estimates of peak demands for December, 1943, are reported to amount to 37,634,252 kw., a decrease of 170,000 kw. from the forecast submitted by the utilities in their June report, the commission stated.

MEETINGS

Previously Listed

International Association of Electrical Inspectors—Eastern section, Providence Biltmore Hotel, Providence, R. I., September 20-22; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Roosevelt Hotel, New Orleans, La., September 27-29; C. M. Jones, secretary, 307 Trust Co. of Georgia Bldg., Atlanta, Ga.

Pennsylvania Electric Association—Annual meeting and business conference, Wm. Penn Hotel, Pittsburgh, Pa., September 23; A. B. Millar, managing director, State Street Bldg., Harrisburg, Pa. Electrical equipment committee, Benjamin Franklin Hotel, Philadelphia, Pa., October 14-15; A. N. Shealy, chairman, Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md.

Southeastern Electric Exchange—Engineering and operation section, Tutwiler Hotel Birmingham, Ala., September 23-24. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, 3, Ga.

American Society of Agricultural Engineers—North Atlantic section, Hotel Belmont Plaza, New York, N. Y., September 27-28. R. J. Bugbee, secretary, 121 West St., Rutland, Vt.

International Municipal Signal Association—War conference, Hotel Statler, Cleveland, Ohio, September 27-29. Irvin Schulsinger, secretary, 8 East 41st St., New York, N. Y.

Association of Iron and Steel Engineers—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., September 28-30. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

American Society of Mechanical Engineers—Joint meeting with Engineering Institute of Canada, Royal York Hotel, Toronto, Ont., Canada, September 30-October 2. Annual meeting, Pennsylvania Hotel, New York, N. Y., November 29-December 3. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

National Safety Council—Congress and exposition, Sherman Hotel, Chicago, Ill., October 5-7. N. H. Dearborn, managing director, 20 N. Wacker Drive, Chicago, Ill.

Edison Electric Institute—Accident prevention committee LaSalle Hotel, Chicago, Ill., October 8-9; prime movers, electrical equipment, and transmission and distribution committees, Hotel Cleveland, Cleveland, Ohio, October 11-12. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

National Electrical Contractors Association—Drake Hotel, Chicago, Ill., October 10-11. L. W. Davis, general manager, 633 Investment Bldg., 15th and K Sts., N. W., Washington, D. C.

Kansas Association of Municipal Utilities—Annual convention, Civic Auditorium and Broadview Hotel, Emporia, Kansas, October 11-12. L. C. Angevine, secretary, City Hall, McPherson, Kansas.

Electrochemical Society—Fall meeting, Pennsylvania Hotel, New York, N. Y., October 13-16. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

American Welding Society—Annual meeting, Hotel Morrison, Chicago, Ill., week of October 18. Miss M. M. Kelly, secretary, 29 West 39th St., New York, N. Y.

Engineers Council for Professional Development—Annual meeting, Engineering Societies Building, New York, N. Y., October 23. A. B. Parsons, secretary, 29 West 39th St., New York, N. Y.

National Electrical Manufacturers Association—Annual meeting, Waldorf Astoria Hotel, New York, N. Y., October 25-29. W. J. Donald, managing director, 155 E. 44th St., New York, N. Y.

Joint Fuels Conference—American Institute of Mining Engineers and American Society of Mechanical Engineers—Wm. Penn Hotel, Pittsburgh, Pa., October 28-29. T. E. Purcell, chairman, Duquesne Light Company, 435 Sixth Ave., Pittsburgh, Pa.

Pacific Coast Electrical Association—Wartime technical conferences, southern section, Los Angeles, Calif., October 28; northern section, San Francisco, Calif., November 4. Victor W. Hartley, managing director, 601 W. 5th St., Los Angeles, Calif.

Tighten Deferment of Critical Job Men

Occupational deferments for Selective Service registrants engaged in or qualified to practice one of the 149 critical occupations (ELECTRICAL WORLD, August 21, 1943, page 71) were made even more secure by instructions given local draft boards last week by National Selective Service headquarters.

Under the new regulations, local boards are ordered to refer to the United States Employment Service the case of any registrant, claimed to be in one of the 149 occupations, whom they find does not merit an occupational deferment and whom they classify as 1A. Coincidental with the referral, boards are required to grant a 30-day stay of deferment, during which USES will investigate the case. If USES finds the registrant to be utilizing his highest skill or that he has since been placed in a critical occupation in an essential industry, an additional 10 days will be allowed for employers to file on form 42 A or B for an occupational deferment. When such appeals are filed, local boards will be required to re-open the case and reconsider it on the basis of the new information.

The extended USES control lies in the fact that if the local board continues the registrant in 1A, an appeal will be available, and appeal boards may be expected to hew reasonably closely to the occupational deferment line laid down by War Manpower Commission.

"It is of the utmost importance," local boards were notified, "that registrants (1) who have the necessary qualifications, (2) who are utilizing them to the fullest extent in a critical occupation in war production or in support of the war effort, and (3) whose removal from their present employment would have an adverse effect upon the maintenance of required production schedules, be given the most serious consideration for extended occupational deferment before being reclassified out of a deferred classification into a class available for service."

•

Will Pay on Arrears

Announcement has been made that the board of directors of Central and South West Utilities Co. declared payments on dividend arrears of $1.75 per share on the prior lien preferred stock, $7 dividend series, and $1.50 per share on the prior lien preferred stock, $6 dividend series, payable September 20.

Labor Day Week Output Falls Off

Halting temporarily its swift upward climb, the output curve for the holiday shortened Labor Day week, ended September 11, broke back to the level of the first August week. The amount of electrical energy distributed by the light and power industry for the latest week totaled 4,229,262,000 kw.-hr., compared to 4,350,511,000 kw.-hr. the week previous, according to the Edison Electric Institute. Figures for the latest week represent an 18.0 percent increase over the 3,583,408,000 kw.-hr. output mark of the corresponding week in 1942.

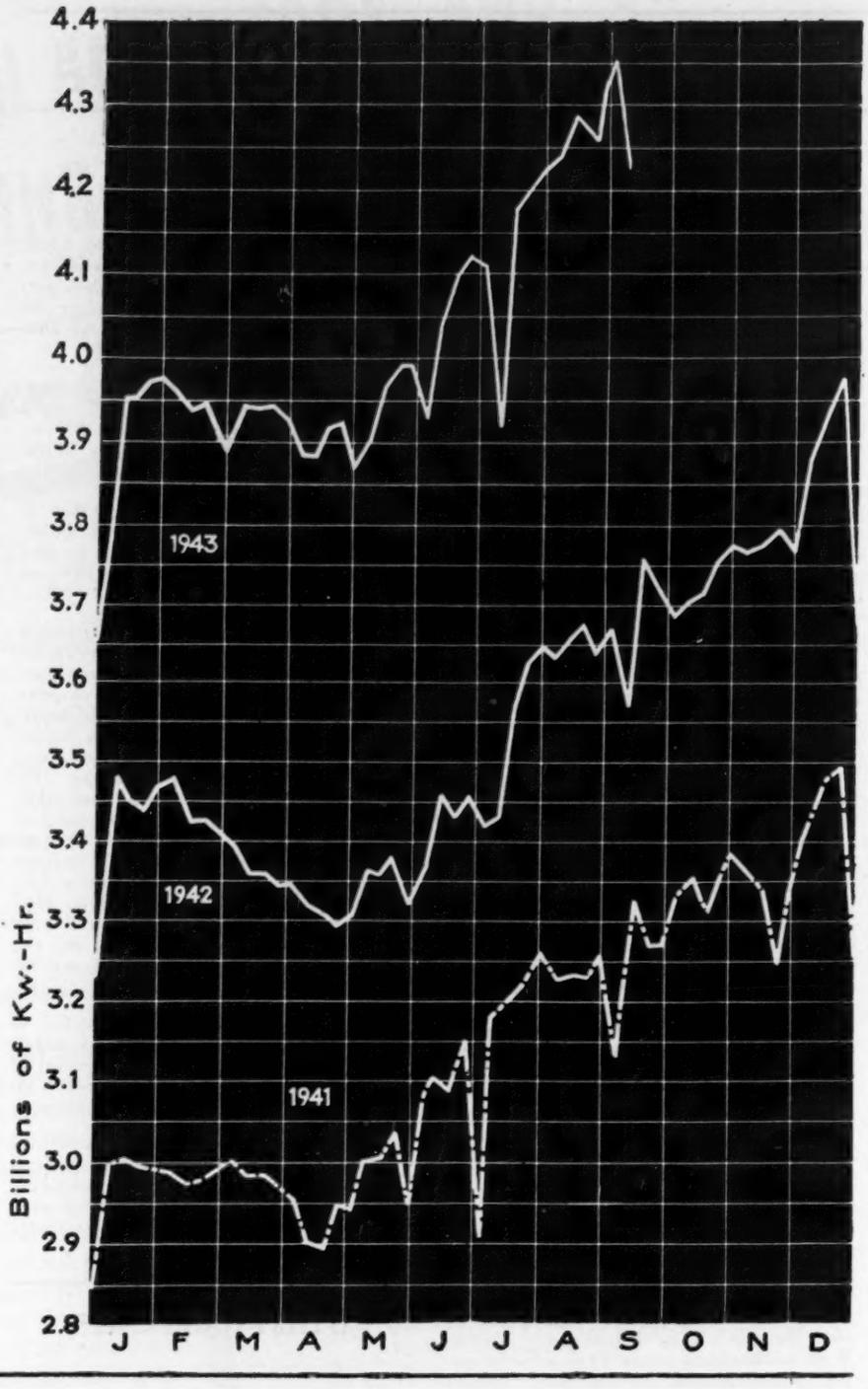
Only three of the seven major geographic regions of the country registered decreases in the percentage of gains over the '42 week chalked up the week previous. Three showed gains over the previous week and one—the Pacific Coast area—remained static at 22.4 percent increase. The three showing gains were the New England, Central Industrial and Rocky Mountain areas. The three showing losses were the Mid-Atlantic, West Central and Southern States. The latter region, however, still held on to first place among all the regions in gains over the 1942 output figures—23.3 percent.

Weekly Output, Million Kw.-Hr.

1943		1942		1941	
Sept. 11	4,229	Sept. 12	3,583	Sept. 13	3,322
Sept. 4	4,351	Sept. 5	3,673	Sept. 6	3,133
Aug. 28	4,322	Aug. 29	3,640	Aug. 30	3,261
Aug. 21	4,265	Aug. 22	3,674	Aug. 23	3,231
Aug. 14	4,288	Aug. 15	3,655	Aug. 16	3,238
Aug. 7	4,240	Aug. 8	3,637	Aug. 9	3,233
July 31	4,227	Aug. 1	3,649	Aug. 2	3,263
July 24	4,196	July 25	3,625	July 26	3,220
July 17	4,184	July 18	3,565	July 19	3,199
July 10	3,919	July 11	3,429	July 12	3,178

Percent Change from Previous Year

	Week Ending		
	Sept. 11	Sept. 4	Aug. 28
New England	+6.2	+5.9	+7.1
Mid-Atlantic	+19.1	+19.6	+19.9
Central Industrial	+15.1	+14.3	+16.4
West Central	+10.3	+11.9	+13.0
Southern States	+23.3	+26.1	+23.0
Rocky Mountain	+18.5	+17.7	+17.6
Pacific Coast	+22.4	+22.4	+22.9
Total United States	+18.0	+18.4	+18.7



South Central Drought Continues

In the east and southeast broad areas of subnormal stream flow have developed as a result of deficient precipitation and high temperature, a continuation of which would result in subnormal water supplies approaching drought severity, according to the August report of the U. S. Geological Survey, in collaboration with Canada's Dominion Water & Power Bureau.

A drought of severe intensity continues in the south-central United States, embracing southern and eastern New Mexico, western Kansas, western Nebraska, Oklahoma, Arkansas, Louisiana, Mississippi, a considerable part of west and north Texas, and western Alabama. In this area, the report said, heavy demands have already been made on storage, and water supplies for stock and for some municipalities are reported low.

In the West, the north-central and northeastern states and in Canada, water supplies continue good to excellent, except locally in areas of heavy pumping. Water supplies have improved in parts of Arizona and Florida.

August, the report points out, is normally a month in which the underground reservoirs are drawn on heavily to supply the demands of growing vegetation, fair-weather flow of streams and springs, and the pumping from wells. This August was no exception, and ground water storage, as shown by the water levels in key observation wells, decreased generally throughout the country. The widespread declines were about average for August, except along the eastern seaboard from North Carolina to Massachusetts, in the Gulf States, and in New Mexico, where they were somewhat greater than usual.

SEC DECISIONS - HEARINGS

The Securities and Exchange Commission, in a series of orders issued last week affecting electric utility companies:

APPROVED THE MERGER of four subsidiaries of the General Gas & Electric Co.—Florida Public Service Co., Sanford Gas Co. and Santa Fe Land Co. into the Florida Power Corp.—and the issuance of 3,000,000 shares of no par common stock by the surviving company, subject to certain conditions. The transaction was described as a step toward compliance on the part of General Gas with the "death sentence" provisions of the Holding Company Act. Florida Power will continue as a subsidiary of General Gas in the Associated Gas & Electric Corp. system. Condition imposed was that Florida Power Corp., within one year, divest itself of all water, gas and ice properties, other than those serving Orlando and Winter Garden, Fla. Decision was reserved on proposals which included the reorganization of Georgia Power & Light Co., another General Gas subsidiary.

GRANTED PERMISSION TO Cities Service Power & Light Co. to spend not more than $1,000,000 to purchase in the open market its outstanding 5½ percent debentures, due 1949 and 1952, during the next three months.

APPROVED THE SALE by Electric Power & Light Co. of 450,000 shares of the common stock of Idaho Power Co., a subsidiary, representing its sole interest in that company. Approval was conditioned on the termination by Idaho Power of the existing contract between that company and Ebasco Services, Inc. Sale of Idaho's common stock by Electric was described as a step in the holding company's voluntary plan for compliance with the Holding Company Act. Electric Power & Light is a sub-holding unit in the Electric Bond & Share Co. system.

GRANTED Middle West Corp. permission to sell to Kansas Power & Light Co. 59,500 shares, being all the outstanding common stock, of its subsidiary, Kansas Electric Power Co., for $2,500,000 in cash. Proceeds from the sale will be distributed to Middle West stockholders within 24 months following consummation of the sale. Kansas Power & Light is a subsidiary of North American Power & Light Co. in the North American system.

APPROVED PROPOSAL of Buckeye Light & Power Co. to issue a 6 percent promissory note in the amount of $76,500 to its parent, United Public Utilities Corp. Proceeds will be used to retire Buckeye's 7 percent first mortgage purchase bonds, due May 15, 1943.

APPROVED PROPOSAL of Milwaukee Electric Railway & Transport Co. to redeem on October 1, at par plus accrued interest, $500,000 principal amount of its 4 percent first mortgage bonds, owned by Wisconsin Electric Power Co., the parent. The company was also permitted to purchase for retirement 4,000 shares of its capital stock, with an aggregate value of $400,000, from Wisconsin Electric. Wisconsin is a unit in the North American system.

GRANTED APPLICATION of Federal Light & Traction Co. permission to spend not more than $100,000 for open market purchases of shares of its outstanding $6 cumulative preferred stock during the next three months.

AUTHORIZED THE SALE of all the outstanding securities of Arkansas Utilities Co., a subsidiary of Southwestern Public Service Co., to Gus B. Walton of Little Rock, Ark., for $1,500,000.

PERMITTED Iowa Power & Light Co. to accept the proposal of a group of underwriters to purchase $17,000,000 of its first mortgage bonds, 3¼ percent, due 1973, at 107.56.

DENIED Lawrence R. Condon, attorney for a group of preferred stockholders in the North American Light & Power Co., leave to intervene with respect to inter-company claims between units in the North American Co., the parent, now pending before the commission. Mr. Condon, however, was granted permission to file with the SEC and serve upon North American and other parties to the proceedings, a statement of any claim against North American, asserted by him on behalf of North American Light & Power and Illinois Traction Co., pertaining to the statement of claims filed by Illinois Iowa Power Co. against the three companies mentioned. Hearings on the inter-company claims were re-convened for Sept. 28.

PERMITTED West Texas Utilities Co. to accept the proposal of a group of underwriters for $18,000,000 principal amount of 3¼ percent first mortgage bonds, Series A, due 1973, at 101.605, plus accrued interest.

DENIED PETITIONS of Cities Service Power & Light Co. and its subsidiary, Federal Light & Traction Co., asking a rehearing on an August 17 order of the commission requiring divestment of properties under Section 11 (b) (1) of the Holding Company Act. The SEC order granted the companies a partial stay, however, in order that additional evidence might be presented concerning the retainability of certain non-utility properties in the system.

PERMITTED General Gas & Electric Co. to pay out of unearned surplus or capital a quarterly dividend of $1.25 on its publicly held $5 prior preferred stock. The dividend is for the period ended September 15.

GRANTED North American Light & Power Co. a 5-month extension, until December 30, to comply with a commission order of December 30, 1941 directing liquidation of the holding company under Section 11 (b) (2) of the Holding Company Act.

GRANTED to the trustees of Associated Gas & Electric system exemption from provisions of the Holding Company Act regarding acquisition of securities as part of compromise of claims of estates. One compromise covered the "Mange Group" claims and the other those of the estate of Frederick S. Burroughs. In a separate order, the SEC extended until December 1 the date for maturity on $75,000 of trustee's certificates of Associated Gas & Electric Co.

Applications Filed

In addition, the Securities and Exchange Commission announced receipt of the following applications from utility companies:

PROPOSAL of Central Ohio Power & Light Co., a subsidiary of Crescent Public Service Co., to pay out of earned surplus a dividend of $1 per share to holders of its common stock in October, such dividend aggregating $20,000.

APPLICATION of Consolidated Electric & Gas Co. and its subsidiary, Bluefield Gas Co., for acquisition and retirement of the latter's outstanding 25-year, 5 percent gold bonds, due October 1, 1937, in the aggregate principal amount of $100,000. Proposed transaction is preliminary to dissolution of Bluefield.

Hearings Scheduled

The commission also announced that hearings on pending applications had been set for the following dates:

SEPTEMBER 20: Hearing on application of Utility Service Co. for an order declaring that it had ceased to be a holding company. Application declares that the company has been dissolved as a corporation under the laws of Delaware, and its assets transferred, including the securities of certain holding companies and the Marion Reserve Power Co., to its sole security holder, Manufacturers Trust Co., an exempt holding company.

OCTOBER 12: Hearing on joint applications of Middle West Corp. and two holding company subsidiaries, Central & Southwest Utilities Co. and American Public Service Co., for approval of a plan to merge American into Central and change the stock capitalization of both companies into a single class of common stock in a new company—Central & Southwest Corp.

OCTOBER 12: Postponement of a hearing originally set for Aug. 3 and later postponed to Sept. 8 on plan of Consolidated Electric & Gas Co. for compliance with the simplification and integration provisions of the Holding Company Act.

UTILITY REPORTS

	Net Income 1943	1942
*American Gas & Electric and subs.	$11,834,495	$12,087,901
*American Power & Light and subs.	16,288,574	7,05[illegible]
*Birmingham Electric	1,482,565	1,01[illegible]
*Carolina Power & Light	2,511,637	2,599,[illegible]
*Central Arizona Light & Power	1,040,172	[illegible]
†Electric Power & Light	9,139,008	8,030,294
†Illinois Iowa Power	3,159,937	3,102,905
*Minnesota Power & Light	2,021,596	1,475,544
*Pacific Power & Light	1,123,303	730,501
*Pennsylvania Power & Light	6,082,561	5,041,457
†Public Service Oklahoma	1,780,835	1,645,475
*Puget Sound Power & Light and subs.	4,639,211	3,124,528
*Utah Power & Light and subs.	2,126,970	1,858,3[illegible]
*Virginia Electric & Power	4,274,256	3,674,109

*Twelve months ended July 31.
†Twelve months ended June 30.

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Remember, too, "G-E Renewal-parts Service" is tailored to the requirements of your lighting system. An important feature is the company-personalized Standardization Charts. These charts illustrate and list catalog numbers of particular combinations of Novalux luminaires, brackets, and accessories. They are of great assistance to engineers and storekeepers in keeping stock control and in the standardization of equipment. A G-E lighting specialist will be glad to assist you in preparing the data for the charts.

General Electric Company, Section A452-20
Schenectady, N. Y.

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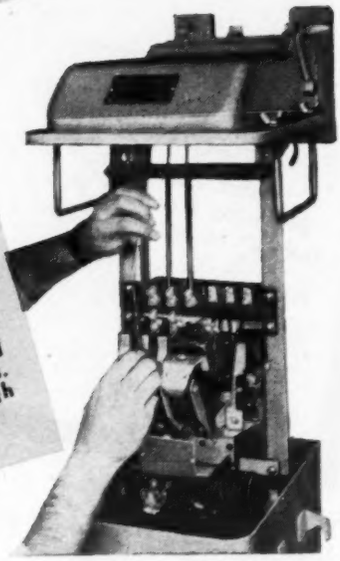
Dust-tight Combinations. For extremely dusty locations. Available through NEMA Size 5.

General-purpose Type. For indoor installations where atmospheric conditions are normal. Available through NEMA Size 5.



For Corrosive Locations. Oil-immersed. Two forms—for both corrosive and hazerdous locations. Available through NEMA Size 5.

New High-voltage Combination. Recently developed—provides split-cycle, short-circuit protection and starting means for 2300- and 4000-volt motors.

COMBINATION STARTERS for motors from 1 to 1000 h

cause . . . they save vital materials

● By buying both the motor-circuit switch and the magnetic starter as one compact unit, you save the copper wire, steel conduit, and fittings that are necessary for installing two separately mounted devices—plus the saving gained by using only one steel enclosure instead of the two individual cases required for separate controls.

cause . . . they can be installed easily by "green" crews

● G-E combination starters eliminate one complete mounting job on every installation—a time saving of up to 50 per cent. They are completely wired at factory, so all you need do is to connect power, motor, and control leads—saving up to 40 per cent in wiring time.

ecause . . . they reduce costly accidents

● Combining the motor-circuit switch in the same case with the magnetic starter makes it possible to mechanically interlock the switch with the door so that the door cannot be opened while the power is on. (With separate devices, there is nothing to prevent the operator from opening a case on a "live" starter.)

Write for these Bulletins

CR7008 FULL-VOLTAGE MAGNETIC COMBINATION STARTERS —BULLETIN GEA-3715

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General Electric Company, Section J 676-94
Schenectady, N. Y.

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GENERAL ELECTRIC

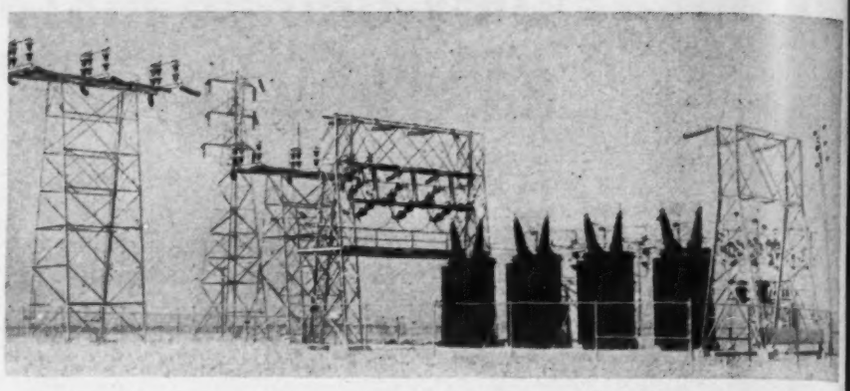
HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

High-Voltage Fuses in Place of OCB

By B. D. DEXTER
Assistant Engineer
Pacific Gas Electric Company

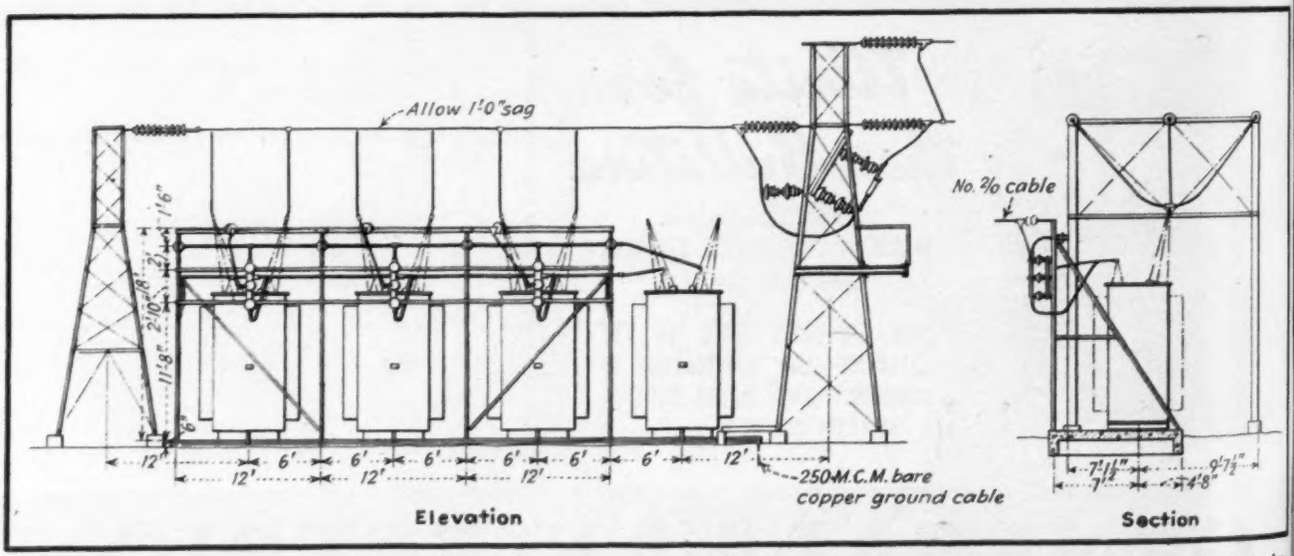
Principal element of cost in serving loads from source voltages of 60 to 100-kv. is suitable automatic circuit-opening equipment. In instances where magnitude of load and revenue are sufficient, automatic circuit breakers are essential. However, there are occasional instances where loads ranging from 1,500 to 5,000 kva. must be served from 100-kv. transmission lines where economics rule against use of circuit breakers. In such instances protection can be provided by high-voltage, high-capacity fuses.

Typical of such installations is a recent substation erected by Pacific Gas & Electric Company to serve rural and dredging loads. The station, rated at 100/17-kv., contains four 1,667-kva. transformers serving two feeders on the low side. It is fed from taps from two adjacent 100-kv. lines. The 17-kv. circuits have automatic reclosing equipment installed. However, on the high side type COR 75-amp., 115-kv. fuses rated at 500,000 kva. interrupting capacity are installed. They are supported on a steel tower as indicated in the accompanying sketch and are equipped with fuse-grounding switches.



FOR SERVING rural and mining load, this 5,000-kva., 100-kv. station using high-voltage fuses instead of breakers shows great economy in cost of protective equipment

Cost of this protective equipment in place was approximately $4,200. An oil circuit breaker of similar interrupting capacity installed in place with by-pass and disconnecting switches, storage battery, etc., would



FRONT AND SIDE ELEVATION of 100/17-kv. substation in which high-voltage fuses take the place of breakers, showing simplicity of station layout

Quickest Way TO SUPPLY REACTIVE and RELEASE SYSTEM CAPACITY

INSTALL CAPACITORS IN LARGE BANKS NEAR THE LOAD

There are three good reasons why large banks of capacitors have become so popular as a means of supplying wartime demands for large blocks of reactive kva. First, their *availability* makes them the quickest reactive source that can be installed. Second, they can be installed at a cost of well under $10 per kva. Third, relatively little critical material is needed in their manufacture as well as in their installation.

By installing capacitors in large banks near the load, the generators and transmission lines throughout the system will be relieved of reactive load, and thus will be free to deliver more kilowatts.

Banks of G-E Pyranol capacitors are available as large, outdoor and indoor rack-type equipments. Many companies have found it advantageous to mount outdoor-type units on temporary structures, so they can use these capacitors in smaller groups on distribution circuits when the emergency need for larger banks is past.

Ask your G-E representative for his suggestions on the application of capacitors in large banks. He'll be glad to help you with such problems as fusing, relay protection, and switching. Or write for Catalog GEA-2746B. *General Electric Company, Schenectady, N. Y.*

This large bank of 288 capacitors was recently installed by a Western power company to release system capacity. The largest of seven installations, it consists of 4320 kva of 15-kva Pyranol capacitors. All of these installations have wood structures.

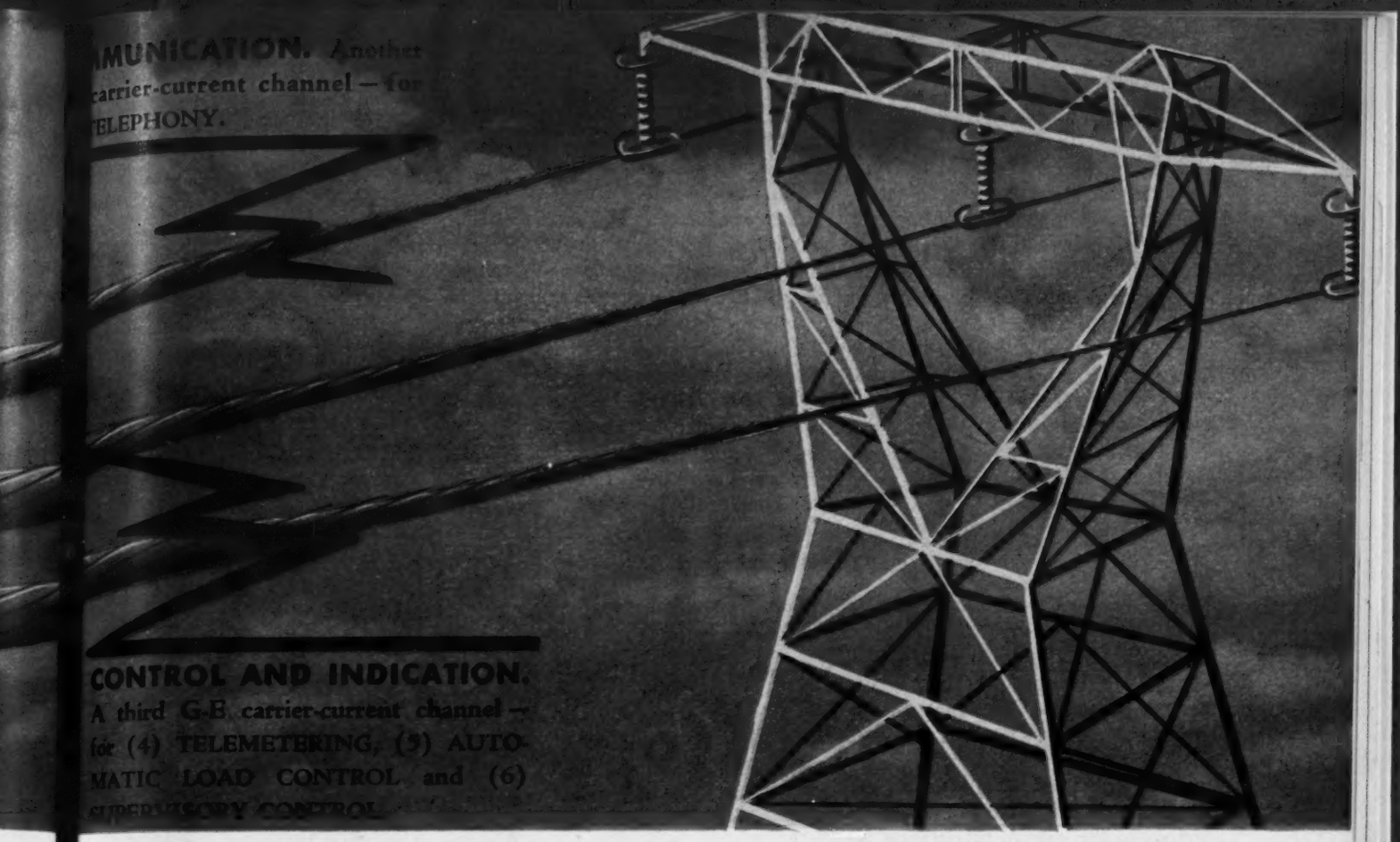
PYRANOL CAPACITORS

GENERAL ELECTRIC

typical services over one line!

An example of 6 important functions performed through 3 G-E carrier-current channels using 1 power-transmission line

GENERAL ELECTRIC



Protection — communication — control — indication. Without separate wires! Without the use of vital war materials for new wire-line construction!

Protection that virtually "beats trouble to the punch". . . spots faults instantly . . . isolates them quickly . . . thus permitting the remainder of the system to maintain service. May allow heavier loading of lines—*safely*.

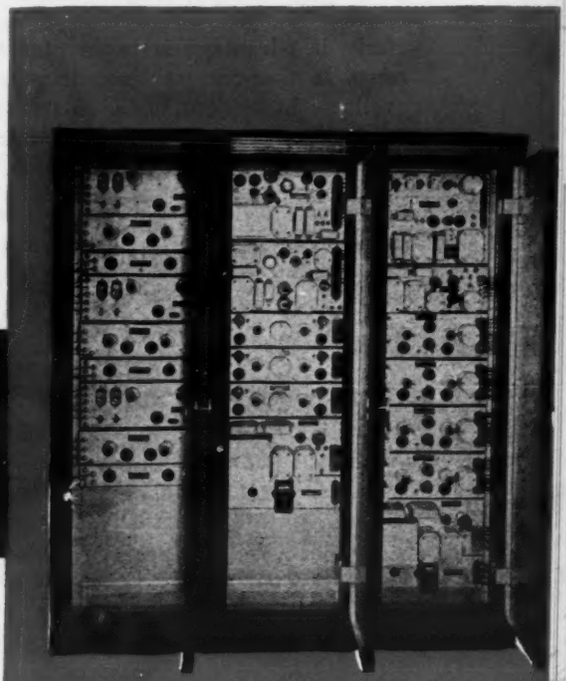
Communication that saves many miles of telephone-line construction. Stands up through storm and catastrophe. Keeps men and machines under the unified guidance of the load dispatcher.

Control and Indication. *Telemetering* that brings load readings on system-wide transmission lines right to the desk of the chief load dispatcher. *Load control* that automatically regulates the power flow over important lines by controlling a selected generating plant. *Supervisory control* that affords accurate and reliable supervision of remote stations.

These are the principal carrier-current services used by power companies. They are modern means of power-system control. . . . They open the road to better operation and economies.

No matter whether you need one or many carrier services, you can get each in a "packaged" standardized design — including coupling capacitors and line traps. *And with the high quality and dependability that only thorough manufacturing, application and installation "know-how" can assure!* General Electric has 20 years of successful research, development and practical experience in this field. Call in a G-E engineer — whether on present plans or merely for preliminary information. *Electronics Department, General Electric, Schenectady, New York.*

Tune in "THE WORLD TODAY" and hear the news direct from the men who see it happen, every evening except Sunday at 6:45 E.W.T. over CBS. On Sunday listen to "The Hour of Charm" at 10 P.M. E.W.T. over NBC.



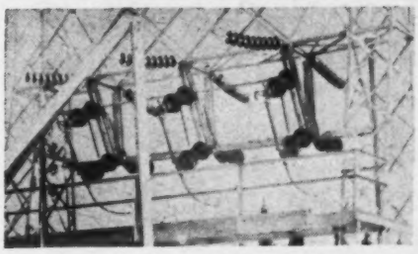
GENERAL ELECTRIC HAS PLANNED AND BUILT MORE CARRIER-CURRENT EQUIPMENT NOW INSTALLED THAN ALL OTHER MANUFACTURERS COMBINED

CARRIER CURRENT

THE NERVE NETWORK OF THE POWER SYSTEM

have cost approximately $22,500. The saving is amply warranted in the case of low-revenue loads of the type served by the station.

Disadvantages of fuses as compared with a circuit breaker are that service will remain out until a fuse can be replaced and also that there may be added maintenance due to fuse replacements. Also, switching out is not so convenient because the station



CLOSEUP of fuse structure showing how the type COR 75-amp., 115-kv., 500,000-kva. rupturing capacity fuses are installed

must be killed manually with air disconnect switches. None of these are serious in the case of this station because the types of loads served do not demand service of the type furnished normal industrial loads. The fuse replacement costs offset such circuit breaker maintenance charges as filtering oil, routine inspection of breakers and inspecting, testing and maintenance of relays, battery and control circuits.

In installations of this type the coordination of high-voltage fuses with low-voltage feeder breakers and with oil circuit breakers at sectionalizing points in the high-voltage system is relatively simple. This is true particularly if advantage is taken of the range in time-current characteristics available in modern fuses. A minor precaution to be observed is to leave the neutral of star-delta banks ungrounded to avoid the blowing of fuses on transmission line faults.

•

Jumper Facilitates Line Reconnection

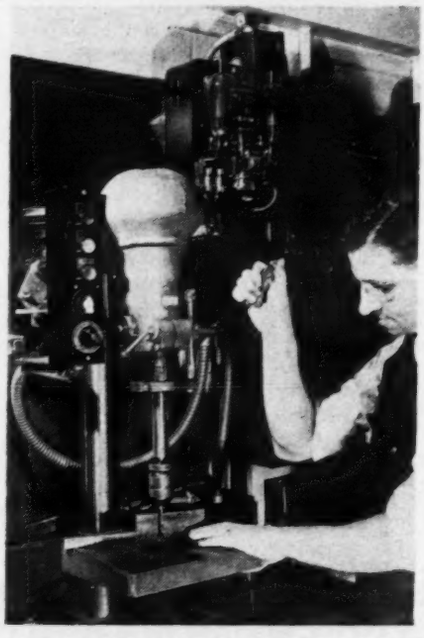
Reconnecting a section of rural line to the hot end on a windy, rainy night after a spot of trouble has been cleared, while spectacular to any onlooker who happens to be present, is not pleasant to the man up on the pole. Sparks spit in his face as his fingers, incased in rubber gloves with leather ones over them, fumble clumsily with the nuts and bolts of parallel clamp connectors.

But any would-be spectator who comes out into the dark, wet night in the hope of seeing a display of fireworks when a section of Virginia Public Service rural line is being reconnected will have only his trouble for his pains. He will see nothing. Because the lineman will have carried with him up the pole a light jumper with Kearney spring clamps at the ends. He hooks the jumper around the dead-end insulators and then makes the permanent connection without any trouble.

•

Electronic Drive Serves Drill Press

Application of a 1/3-hp. Thy-motrol drive to a small drill press has greatly increased the drill's field of usefulness. A range of operating speeds from 25 to 1,750 r.p.m.—obtained simply by turning a small knob on a push-button station located at left of drill head—enables this simple drill press to do jobs that would otherwise require a more complicated ma-



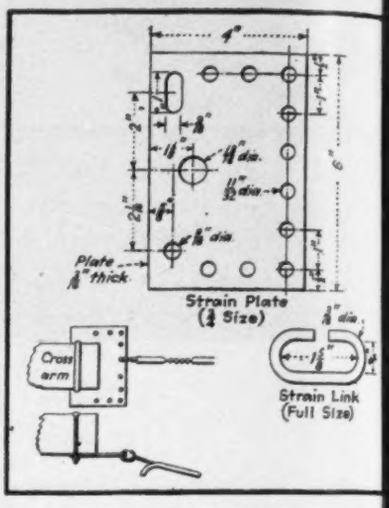
DRILL PRESS equipped with electronic motor drive; control panel shown with cover removed

chine or machines. Speeds available on the drill are now much slower than those obtainable without changing pulleys on similar drills, so that the drill can be used on hard-to-drill materials, such as molded compound and for the fly cutting of large diameter disks.

Since the drive permits reversing as well as independent adjustment of speed in each direction, tapping can be done at the proper pre-selected speeds for both tap and backout. The installation is at General Electric's Schenectady plant.

•

Strain Plate for Service Cable



Shown is the type of dead-end strain plate developed by engineers of the Empire District Electric Company, Joplin, Mo., for supporting low-voltage service cable from the end of a secondary crossarm. As shown, the plate is fastened to the end of the crossarm by a crossarm strap. The bails of service cable grips are passed through open links that engage any one of a number of holes in the plate, depending on the take-off angle. A ⅛-in. hole is also provided in the plate for bolting to a pole or crossarm.

•

Uses Iron Wire as Proxy Welding Rod

With welding rod a wartime priority item, practical substitutes are being sought out. Maintenance men at plants of the Oklahoma Gas & Electric Company have found an acceptable one in ordinary black annealed iron wire—about the cheapest grade obtainable. This they use as electrodes in building up and restoring worn machine shapes and surfaces on plant

Small Diameter

FLAMENOL*
BUILDING WIRE

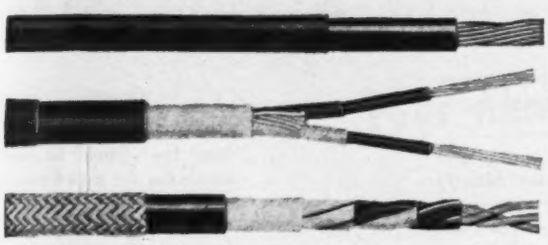
TYPE SN

Again thermo-plastic small diameter Flamenol Building Wire is available for war-purpose wiring. The available supply of resins has improved. They are permitted for electrical conductor insulation wherever copper is allocated.

Use this easy-to-handle, dependable wire for maintenance jobs, for rewiring and for new wiring. Its small diameter permits more wires to be used in conduits for both rewiring and new wiring. Its insulation is superaging, high in dielectric and mechanical strength, flame retarding and resistant to moisture, oil, acid, etc. It is available in sizes 14 and larger which enables it to be used for feeders as well as branch circuits.

FOR FURTHER INFORMATION on Flamenol Building Wire, G-E Small-boat Cables, conduits or wiring devices, see your G-E Merchandise Distributor or write to Section CDW-935-9, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

G-E SMALL-BOAT CABLES

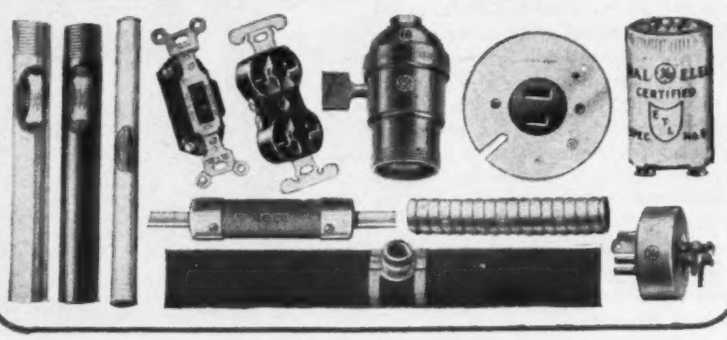


G-E Small-boat cables are designed especially for use on the small boats being built for the U.S. Government's boat building program. They are available with one, two, three or four stranded copper conductors and are well designed and carefully made. The conductors have Flamenol* insulation. Cotton fillers are cabled with the conductors under a Flamenol* sheath. This sheath is resistant to oil, gas, acid, sunlight, salt water, etc. Over-all is a moisture-resisting and flame-retarding cotton braid. (Galvanized steel braid with aluminum paint on armored cables.) G-E Small-boat Starter Cables are also available.

*Reg. U.S. Pat. Off.

G-E WIRING DEVICES AND CONDUITS

General Electric offers five conduits and hundreds of wiring devices for war jobs including: G-E White zinc covered conduit, G-E Black enamelled conduit, EMT, flexible metal conduit; and switches, lampholders, outlets, fuses, etc.



GENERAL ELECTRIC

equipment, by metallic arc welding.

Operators report that about a No. 8 wire size wire makes the best welding rod. They report also that where the substitute rod has been used to restore surfaces worn by abrasive action the resulting new surface has revealed very good wearing characteristics.

Among the uses to which iron wire welding rod has been put are: On coal-pulverizing equipment, coal feeders, and piping where it is desired to restore eroded or abraded surfaces to original contour. The grinding ring in a type B, B&W, 7½-ton capacity coal pulverizer was built up to contour by arc welding, checking with a template and high spots peened or ground down. A worn exhauster fan casing or shell was restored in this manner, as were cast-iron parts of piping between the exhauster and the pulverized fuel burners.

It is well to add a caution that this type of electrode should not be used where strength of the weld is a factor, at least until tests have been made to determine its suitability.

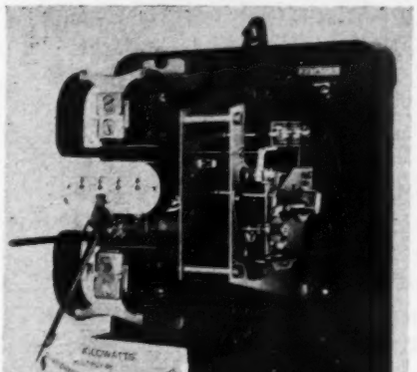


FIG. 3—Tripping mechanism now coupled to the timing gear train →

Done by supplanting the reset knob and pointer with a wheel fixed on the shaft, which wheel engages an identical wheel which turns freely on an extension of Shaft Assy. No. 2 (tripout). This second wheel is coupled to the extended shaft, on which it turns by a conical reset spring working over a cone. To make room for this second wheel it is necessary to move the tripping bracket support to one side. The synchronous timing motor thus stores up energy for tripping in the reset spring during the time interval. Because of the added load on the motor it is necessary to "freeze" the friction clutch in the timing gear train in order to prevent slipping. Because of the extended shaft added on the clock it was found necessary to mount the clock 1½ in. nearer the top of the base.

Graphic Demands Made Over to Indicating

By T. E. LOBECK,
Meter Engineer
Northern States Power Company, Minneapolis

Due to rate changes, we found that we had approximately 200 transformer type Westinghouse RA recording demand meters with the open type synchronous motor clock, which were to be supplanted by indicating demand meters of the block interval type. It was decided to rebuild them to the indicating type by making a few simple changes (see illustrations) and at small expense for labor and material. The rebuilt meters have proved satisfactory in every respect and can, if necessary, be changed back to the original form.

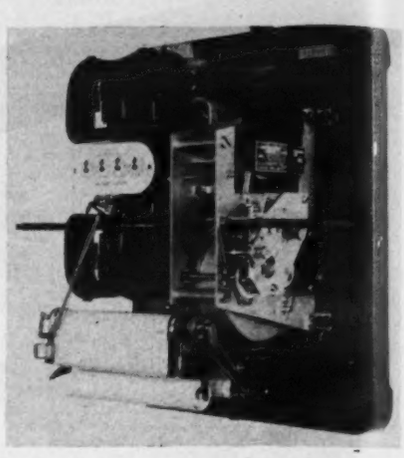


FIG. 1—Familiar RA meter has open type synchronous motor clock →

Powerful hand-wound spring furnishes the power for the tripping mechanism and also for advancing the chart. In order to wind this spring it is necessary to remove the meter cover. Since there would be no other reason for removing the cover on an indicating demand meter, and it was deemed desirable to make the meter completely automatic, it was decided to eliminate the spring-driving mechanism and to supply the energy for the tripping mechanism from the synchronous timing motor.

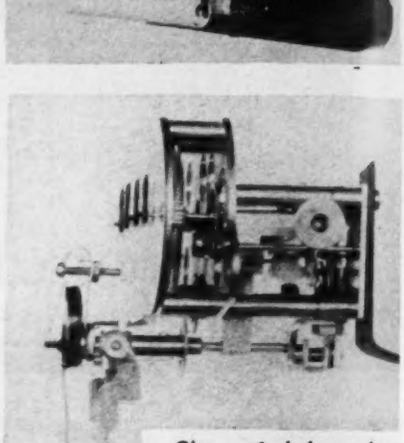
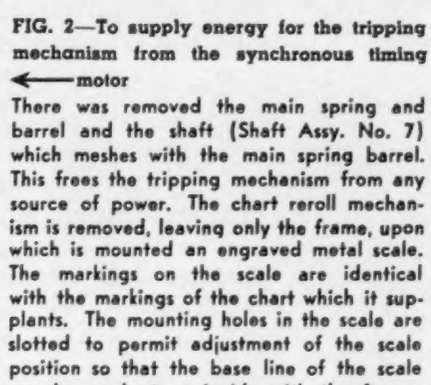


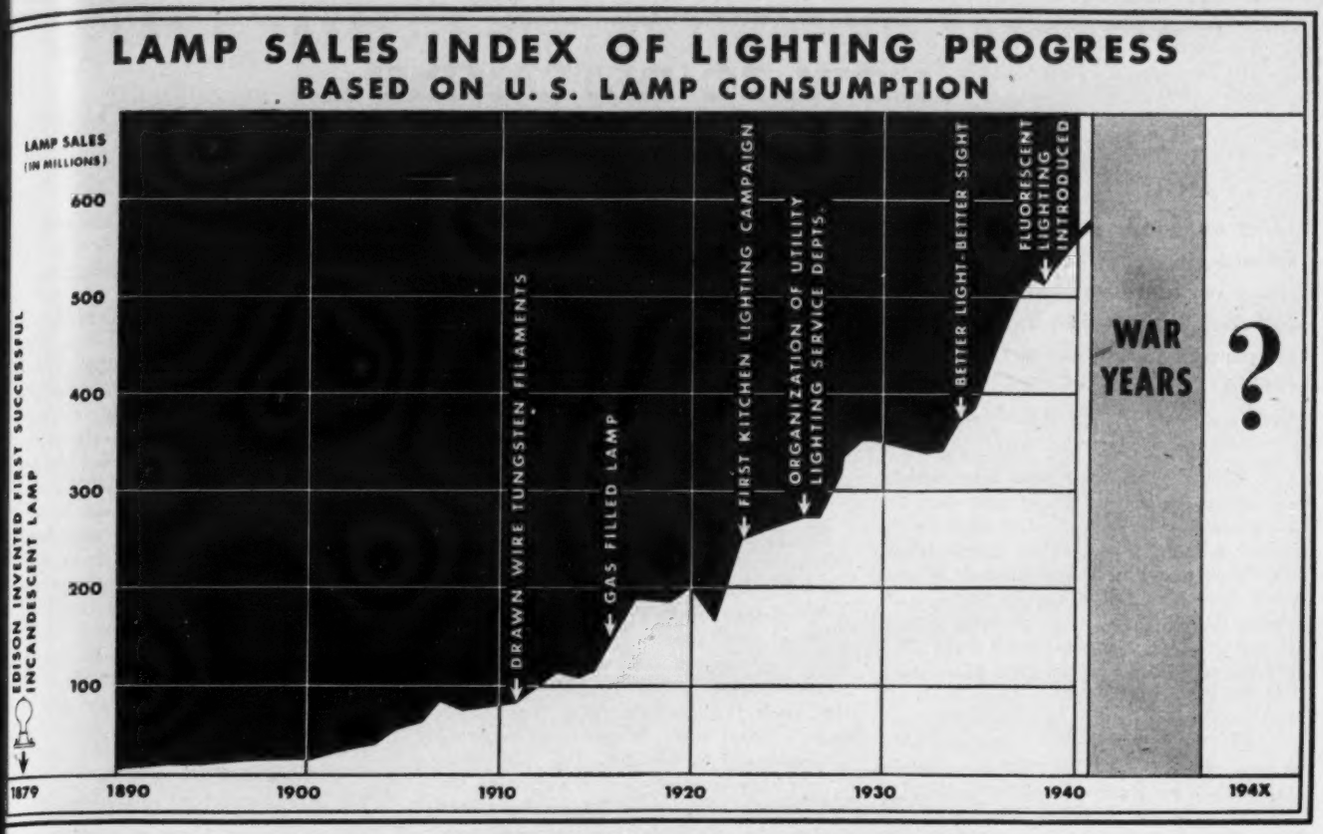
FIG. 2—To supply energy for the tripping mechanism from the synchronous timing ←motor

There was removed the main spring and barrel and the shaft (Shaft Assy. No. 7) which meshes with the main spring barrel. This frees the tripping mechanism from any source of power. The chart reroll mechanism is removed, leaving only the frame, upon which is mounted an engraved metal scale. The markings on the scale are identical with the markings of the chart which it supplants. The mounting holes in the scale are slotted to permit adjustment of the scale position so that the base line of the scale can be made to coincide with the former pen arc. The cover is provided with a conventional set-back device.



Changes include supplanting the front bearing screw for the pen support mechanism by a similar screw having a broader head to obtain a greater friction surface. The maximum demand pointer is made of a tapered strip of hard bronze 0.004 in. thick provided with a counterbalanced hub and a bearing shaft. It is held in place on the register, and the correct pointer friction obtained, by the friction tension spring, made of the same flat bronze stock, and the tension adjusting screw. The lower end of the tension spring is held under the head of the new bearing screw. There is a felt friction washer between the pointer bearing surface and the bearing screw. The existing pen arm is used as the pointer pusher by removing the pen proper and attaching, at right angle to the pen arm, a pin about 1 in. from the end. This pin engages the friction pointer and pushes it up scale. The pen arm drops back to zero at the end of the time interval, leaving the maximum demand pointer at the highest point reached. Zero adjustment is made in the same manner as before.

FIG. 4—Changes in the pen mechanism



Curve of lamp sales, adjusted for average wattage and efficiency, is for all practical purposes a curve of lighting kilowatt hours. The above chart, therefore, indicates not only a steady increase in lamp sales but also in lighting load.

LIGHTING — your immediate post-war load builder

LIGHTING presents to every utility an opportunity for *immediate* load building in the post-war period . . beyond anything the lighting industry has ever known. We don't know exactly how high the load will be, but we do know that:

1. The trend of the lighting load always has been upward, particularly in recent years under the stimulus of Better Light—Better Sight.

2. The number of empty sockets—an average of 10 per cent of the nation's residential sockets in peacetime—is undoubtedly far higher now.

3. The vast pent-up demand for better lighting, particularly in the commercial and home fields, grows larger day by day.

4. And at the close of the war, the lighting industry won't have to wait for retooling and revision of production facilities to meet the demand. The curve of lighting load can resume its upward climb without delay.

Forward-looking utility executives already are thinking about the answers to questions like these: How about a socket-filling lamp-bulb campaign as our first post-war promotion? How much additional man-power will we need to develop the commercial and home lighting fields? How will we train them? How about special man-power for dealer contacts? And how about a consistent, continuous program of lighting promotion and advertising?

The lighting industry shares with other industries the task of providing full post-war employment. And the lighting industry has a better opportunity for immediate action than most others. Year after year the lighting load has increased. The rate of increase can be stepped up even further in the post-war years.

Hear the General Electric Radio programs: The "Hour of Charm", Sunday, 10 p. m. EWT, NBC; "The World Today" news every weekday, 6:45 p. m. EWT, CBS.

G-E MAZDA LAMPS

GENERAL ELECTRIC

THE BEST INVESTMENT IN THE WORLD IS IN THIS COUNTRY'S FUTURE — BUY WAR BONDS ★

HOW TO DETERMINE SAFE LOADS FOR WIRE ROPE SLINGS

An outline is presented for conditions under which wire rope slings may be used safely. Accompanying information and data are adapted from Industrial Data Sheet D-Gen. 7 issued by the National Safety Council, Inc., Chicago.

1 Wires of the wire rope, from which slings are made, may be of cast steel or plow steel or improved plow steel, with either a hemp center or an independent wire rope center. The wires, when of cast steel, have a minimum tensile strength of about 190,000 lb. per square inch of sectional area, when of plow steel about 210,000 lb. and when of improved plow steel 230,000 lb. or more. Wire rope with an independent wire rope center is approximately 7½ percent stronger than one with a hemp center. In order that the greatest safety may be obtained and that the best and most easily handled sling may be available, wire rope slings should be made from the highest grade, strongest steel; not from the lower strength cast steel and plow steel, nor from the best sections of discarded hoisting cables.

2 Some types of wire rope slings are fitted with equalizing thimbles which allow an even distribution of the load when the sling is under tension. Other types of slings are manufactured endless in what is termed grommet construction. Slings used for general purposes are often fitted with socketed or spliced hooks or thimbles. When a correctly proportioned socket is used and the attachment properly made, it will develop the full strength of the wire rope. The spliced thimble connection has an efficiency varying from 60 percent for 2½-in. diameter rope to 95 percent for ½-in. diameter rope.

3 For slings ⅜ in. to 1⅛ in. in diameter 6 x 19 construction wire rope with independent wire rope center is satisfactory. For slings 1¼ in. in diameter and larger, wire rope of 6 x 37 construction with independent wire rope center should be used.

4 When slings are to be used for special purposes the advice of a reliable wire rope sling manufacturer should be obtained and the sling recommended by him should be used.

5 Wire rope slings should not be used:

(a) If the load to be lifted has sharp corners, unless corner pads are placed between the load and the sling to prevent injury to the wires of the rope strands.

(b) To lift a load where there will be sharp bends of rope over an unyielding surface, as these bends cause extreme tension of the outside wires of the strands.

(c) If the sling shows evidence of nicks, excessive wear or other damage, such a sling should be promptly discarded and destroyed.

(d) If there is danger of getting acid or strong alkali on the sling, as such chemicals will corrode the metal and cause immediate damage to the wires.

6 If wire rope slings are used the following items should be given careful consideration.

(a) Before attempting to lift a load with a wire rope sling, care must be taken to make sure the sling is in proper condition and of sufficient strength to lift the load. This means that the hooks, thimbles and other fittings must be properly fastened to the sling legs (see Note 2). It also means that the weight of the load to be lifted must be carefully estimated and the proper size of sling used (see table).

(b) It should be remembered that a greater load can be safely lifted when all legs of the sling are in a vertical position. On the other hand, the smaller the angle formed between the legs of the sling and the horizontal, the less the weight which may be lifted safely (see table).

(c) All users of wire rope slings should be carefully instructed regarding the safe loads for slings under various conditions, and copies of the table, showing such loads, should be posted in conspicuous locations about the shop. It is also best that each sling bear a tag indicating its safe vertical load capacity.

(d) If three-leg slings are used, safe loads given in the table for double (two-leg) slings may be increased 50 percent, and with four-leg slings 100 percent; *i.e.*, the safe load for a new 1-in. three-leg sling at 60 deg. with the horizontal is 27,300 lb. and for a new four-leg sling of the same size and angle 36,400 lb.

(e) Wire rope slings should be protected from unnecessary wear and should be lubricated and kept free from moisture. For lubrication a lubricant free from acids or corrosive substances should be used. The lubricant should be one that will penetrate the strands and not run off or drip. Its application should be frequent. Care should be taken that the rope of the slings is not kinked, as kinks, even though removed, seriously damage the wires and may cause ultimate failure of the sling under comparatively light loads.

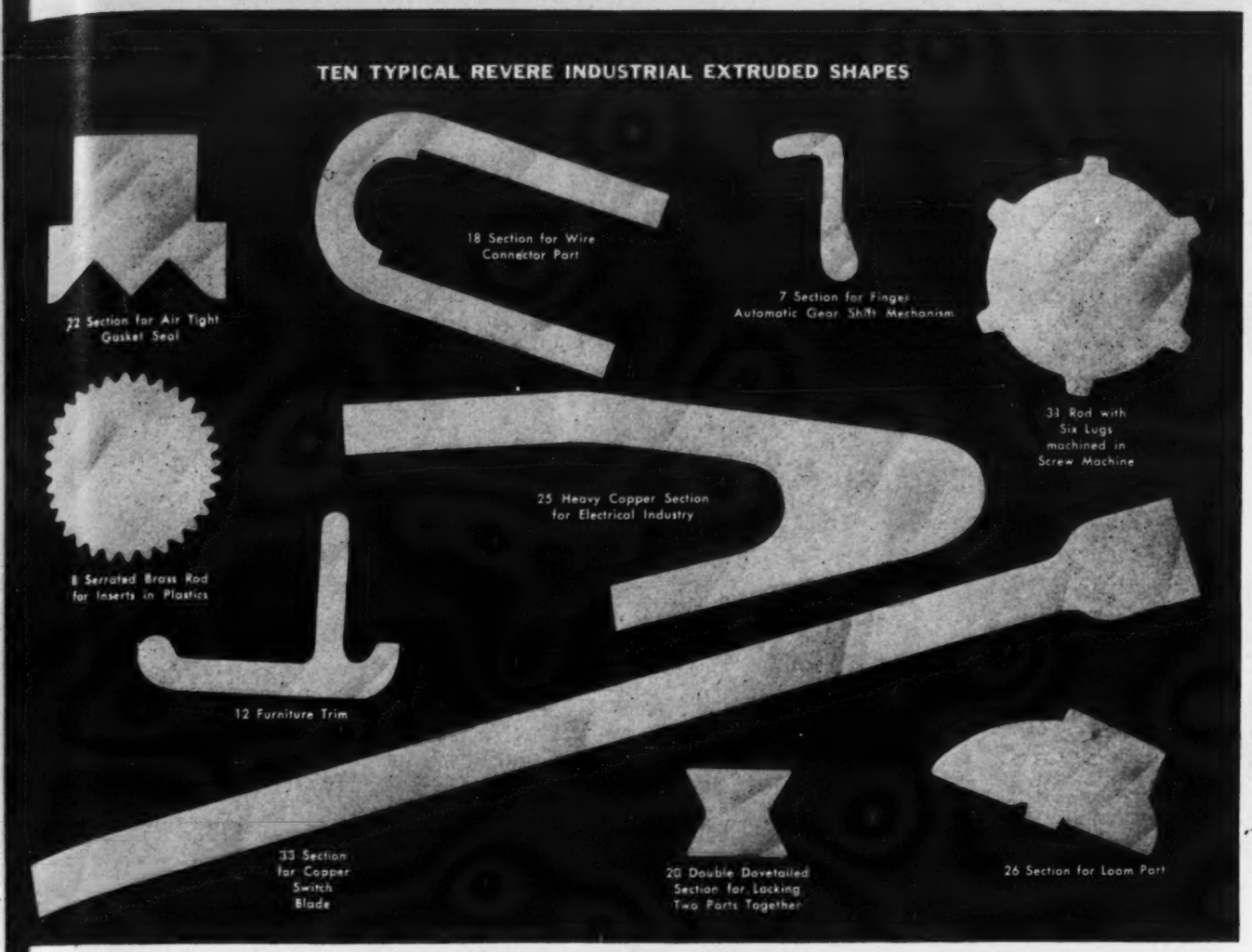
NOTE 1—In computing the safe given loads in the table a factor of safety of approximately 11 has been used. The loads are based on test data furnished by two of the leading wire rope manufacturers.

NOTE 2—For further details on wire rope slings, socketing and splicing of attachments to the slings, the selection of rope for the slings and their care, see National Safety Council Safe Practices Pamphlet No. 26, "Wire Rope."

Safe Loads in Pounds for New Improved Plow Steel Wire Rope Slings with Independent Wire Rope Center Socketed or Spliced for Hook at One End and Hook or Thimble at Other End

Rope Diameter Inches	Single Leg Vertical Sling		Double (Two-Leg) Vertical Sling		Double (Two-Leg) Sling Degree of Angle with Horizontal					
					60 deg.		45 deg.		30 deg.	
	Socket	Splice*	Socket	Splice*	Socket	Splice*	Socket	Splice*	Socket	Splice*
3/8	1,200	1,200	2,400	2,400	2,100	2,100	1,700	1,700	1,200	1,200
1/2	2,000	2,000	4,000	4,000	3,500	3,500	2,800	2,800	2,000	2,000
5/8	4,000	4,000	8,000	8,000	6,900	6,900	5,600	5,600	4,000	4,000
3/4	6,000	5,700	12,000	11,400	10,400	9,900	8,500	8,000	6,000	5,700
7/8	8,000	7,200	16,000	14,400	13,850	12,500	11,300	10,200	8,000	7,200
1	10,500	8,900	21,000	17,800	18,200	15,400	14,800	12,600	10,500	8,900
1 1/8	13,000	10,600	26,000	21,200	22,500	18,400	18,400	15,000	13,000	10,600
1 1/4	15,000	12,300	30,000	24,600	26,000	21,300	21,200	17,400	16,000	12,300
1 3/8	17,000	14,000	34,000	28,000	29,400	24,200	24,000	19,800	17,000	14,000
1 1/2	20,000	16,400	40,000	32,800	34,600	28,400	28,300	23,200	20,000	16,400
1 5/8	22,000	17,200	44,000	34,400	38,100	29,800	31,100	24,300	22,000	17,200
1 3/4	25,000	18,800	50,000	37,600	43,300	32,600	35,400	26,600	25,000	18,800
2	32,000	24,000	64,000	48,000	55,400	41,600	45,200	33,900	32,000	24,000
2 1/4	40,000	28,000	80,000	56,000	69,200	48,500	56,600	39,600	40,000	28,000

Slings 3/8 in. diameter to 1 1/8 in. diameter inclusive 6 x 19 construction rope.
Slings 1 1/4 in. diameter and larger 6 x 37 construction rope.
*Rope with thimble spliced in.


TEN TYPICAL REVERE INDUSTRIAL EXTRUDED SHAPES
18 Section for Wire Connector Part
7 Section for Finger Automatic Gear Shift Mechanism
22 Section for Air Tight Gasket Seal
31 Rod with Six Lugs machined in Screw Machine
25 Heavy Copper Section for Electrical Industry
8 Serrated Brass Rod for Inserts in Plastics
12 Furniture Trim
33 Section for Copper Switch Blade
20 Double Dovetailed Section for Locking Two Parts Together
26 Section for Loom Part

How REVERE INDUSTRIAL EXTRUDED SHAPES Can Speed Production • Cut Down Costs

On some not-too-distant tomorrow, you'll be going again full-blast.

Take Time by the forelock. Investigate today the uses of Revere Industrial Extruded Shapes.

They are made by forcing pre-heated metal through a die of the profile desired. The particular shaping of the die offers wide opportunity for developing *unique* shapes and contours.

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The process is extremely versatile, producing cross sections of unusual form which, in many cases, can take the place of simple forgings, sand or die castings.

Revere Extruded Shapes are readily machined, easily transformed into clean-cut, finished products. With special holders or chucks, odd-shaped sections may be fed, in long lengths, into turret lathes or screw machines where they can be turned or drilled as readily as concentric rods. Their pre-shaped cross-section may eliminate many subsequent milling or broaching operations.

Result: A considerable saving in Tool, Metal and Finishing Costs—an overall saving of time, money, worry —and scrap!

In fact, the use of Revere Industrial Extruded Shapes offers possibilities so numerous that their limitations are determined only by the ingenuity of the user. Available in different alloys and sizes *as well as different shapes.*

Send us a sample or a fully dimensioned profile of your product and we'll definitely let you know if Revere INDUSTRIAL EXTRUDED SHAPES can help cut down your costs and speed production.

FREE We'll be glad to send you for your files our complete brochure for further details on Revere *Industrial Extruded Shapes* included also, is much additional information on Revere Copper and Copper alloys and their indicated use in various mechanical industries.

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AMERICA'S FOOD PROBLEM is a challenge to the Electrical Industry

Monongahela West Penn Public Service Co.

WEST VIRGINIA H-FOR-V CLUB LEARNS ABOUT "WOMEN ON DOUBLE DUTY"

At Grafton, West Virginia, the H-for-V Club, helped by O.C.D., is doing a real job of fitting nutrition knowledge to the "Food Fights For Freedom" campaign.

No. 4 IN A SERIES

Spotlighting six of the many utilities who are already aiding America's Nutrition Program

There's plenty for everyone to do in this war. But there's one job that's made to order for the utilities. That's the all-important task of teaching America how to eat properly, how to avoid waste of food, how to use ration points so that everyone gets a fair share and an adequate diet.

If you have not yet launched a nutrition program, we urge you to give such a project early consideration.

One of the most widely heralded plans for accomplishing these aims is through the Health-for-Victory Program. So perfectly is this nutrition plan adapted to the needs of utilities that they have done a truly magnificent job in gaining acceptance for it all over the country. As proof of this, Health-for-Victory is now being sponsored by utilities for over 1,300 war plants and other organizations.

Because participating utilities have made fullest use of the flexibility of Health-for-Victory, application of the plan varies from city to city. In some places, monthly meetings are conducted by utility home economists. In other cities, the Health-for-Victory Meal Planning Guides—64 pages of menus, recipes and food tips—are made available at cost through utilities and given out by personnel departments and labor-management committees.

Whichever way you prefer to promote Health-for-Victory, Westinghouse is ready to provide you with all the materials required. It is right in line with the plan jointly recommended by EEI and the Council of Electric Operating Companies for co-operation with the Food Distribution Administration.

Health for Victory

Public Service Co. of New Hampshire

GIDDAP NAPOLEONS! LADIES OF FRANKLIN, N. H. RIDE VICTORY COACH TO H-FOR-V MEETING

The gas shortage doesn't stop these resourceful New Englanders from getting to meeting. This horse-drawn equipage is their answer to the emergency.

Idaho Power Co.

BOISE, IDAHO CHURCH GROUP PROUDLY RECEIVES H-FOR-V CLUB CHARTER

This enthusiastic group of civic minded workers acclaim the benefits of their Health-for-Victory Club.

Tidewater Power Co.

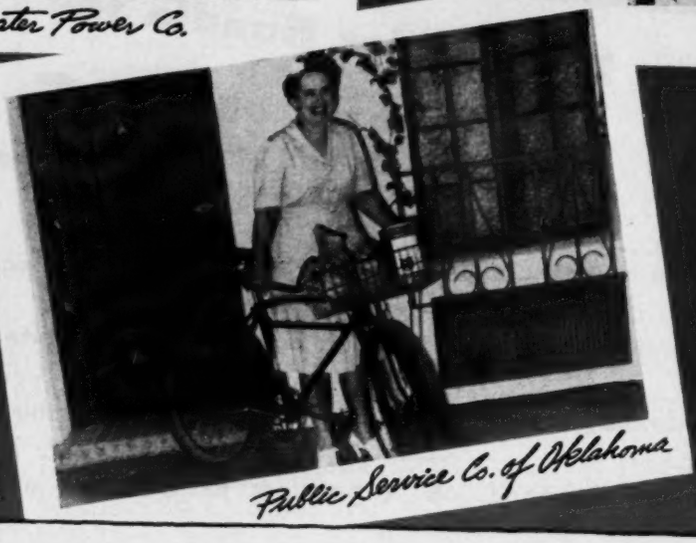
Nebraska Power Co.

THROUGH EFFORTS OF OMAHA CIVIC LEADERS BIG CROWD RALLIES TO HEALTH-FOR-VICTORY

Important Omaha citizens stage big rally to stimulate city-wide interest. Result: Big turnouts at all meetings.

OKLAHOMA MEMBER SAYS, "I'LL FOREGO MY CAR, BUT NOT MY MONTHLY MEAL PLANNING GUIDE."

This patriotic H-for-V member further adds that Meal Planning Guide helps her arrange her shopping to save trips to market.



Public Service Co. of Oklahoma

CONTRIBUTION
AMERICA'S
R EFFORT BY

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Let Hoosier Handle the
TOUGH JOBS

Throughout the country, Hoosier's trained men and special equipment are ready to serve you efficiently and economically. Despite today's existing conditions, Hoosier service is immediately available for any erection or maintenance job, regardless of distance or terrain.

HOOSIER ENGINEERING CO.

ERECTION and MAINTENANCE OF TRANSMISSION LINES

NEW YORK **46 S. FIFTH ST., COLUMBUS, OHIO** CHICAGO

Obsolete Material Reclassified For Use

Slow-moving, obsolete and non-standard material held in stock in the six divisions of the Kansas Gas & Electric Company have recently been the subject of close scrutiny in a war-time campaign to get long idle but still usable material into use; sell what can't be used and junk what is rightly junk. Basic objective of the move is to "clean house" in preparation for post-war operation. As a result of this housecleaning, out of 1,374 non-standard items (there were as many as 400 units of some items) 250 were found to be usable by the company, 643 could be used by others and are to be offered for sale, 386 will be junked, and 95 items remain to be classified.

Segregation

Procedure followed in sorting the material items was simple and direct. Division storekeepers were asked to make a detailed description of each obsolete, non-standard material item in their stock and indicate the number of units of each item.

These data, for each item, were transferred to cards, shown. Each was given a functional classification number and was assigned an arbitrary stock number.

Items in a given functional class were assigned to a committee of qualified engineers familiar with the application of that type of equipment. These committees classified the items as (1) usable by company as is, (2) usable by some one else, either customer, other utility, contractor, etc., (3) junk.

Material of each class items found usable were listed. Each such class list gives a description of the item, its assigned stock number, description and the number of units available. Copies of these lists were distributed to various groups in the engineering department and to the company divisions with the suggestion that the material be used in future jobs. A supplementary sheet was also issued to encourage rapid use of the items; it lists the price of the non-standard item and the standard item for which it can be substituted in the field, for prospective users.

Stock Record

Original cards for the usable items are kept by the company general storekeeper. On the back they indicate the quantity of each item in stock in each company division. Space is also provided for indicating the date on which individual units were charged out. Thus when the storekeeper gets an order for one of the obsolete items by stock number, reference to the card file will disclose how many units of the item remain available and in what divisions they are located. Orders are then issued to the division storekeeper to ship the item to the location where it is needed and a "charge out" entry made on the master card.

KANSAS GAS AND ELECTRIC COMPANY
RECORD OF NON-STANDARD MATERIAL

NO. 2124
CLASS

NAME: Relay

Description: Overcurrent

Make _____ Type 1A-101 Cat. No. _____

Weight _____ Price _____

REMARKS Same as 1A-202 type contacts

Listed By : _____

Date: _____

(See other side for quantities)

QUANTITY IN EACH DIVISION

Ark City	Date	El.D.	Date	Ind.	Date	Newt.	Date	Pittsb.	Date	Wich.	Date
				1	1-9-43						

TOTAL QUANTITY (All Divisions)

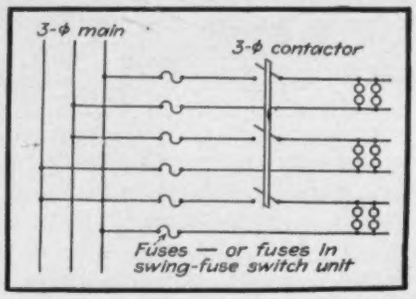
No.	Date	No.	Date	No.	Date	No.	Date	No.	Date	No.	Date

REFERENCE CARDS give essential data on obsolete non-standard stock items for grading as (a) usable, (b) salable, (c) junk. Reverse side indicates number of units available by location

Simple Control for Lighting Circuits

By E. R. BONDS
Robert & Company, Inc., Atlanta, Ga.

Design of a large lighting installation for service from three-phase, 220-volt mains permitted a considerable saving to be made by Robert & Company for the client. Instead of the distribution panels that would have been necessary for supply from three-wire, 110-220-volt mains, it was possible to use small three-pole contactors, each controlling three lighting circuits and installed at points of tap-off from the conductors of the mains.



THREE-POLE contactor switches lighting circuits

The contactor breaks only one side of each of the circuits it controls, as shown in the accompanying diagram. However, all circuit conductors are fused, and thus it is possible, when desired, to disconnect any circuit completely by removing the fuses in that circuit.

Each circuit feeds two combination lighting units. The combination consists of a 750-watt incandescent and a 400-watt mercury lamp, a 2,400-watt total load per circuit.

•

Save 12 Hours in Cooling Manifold

In cooling a 900-deg., 850-psi. steam manifold at the Ohio River station, Evansville, Ind., preparatory to making a new boiler connection, operating engineers of the Southern Indiana Gas & Electric Company saved twelve hours time recently by shutting down the boiler but leaving the valve between it and the manifold open, thus allowing the drop in temperature of the saturated steam to cool the manifold gradually as the

boiler cooled. All other connections to the manifold were closed.

Cooled gradually in this manner, shrinkage stresses were avoided. The time required for cooling to 240 deg. was reduced from an estimated 34 hours, for cooling by normal convection and radiation, to about 22 hours.

Occasion for cooling the manifold was to make a new boiler connection by welding, anneal the weld and make a hydrostatic test. It was necessary, therefore, to cool the manifold to working temperature and do it as quickly as possible so needed turbine capacity could be restored to service.

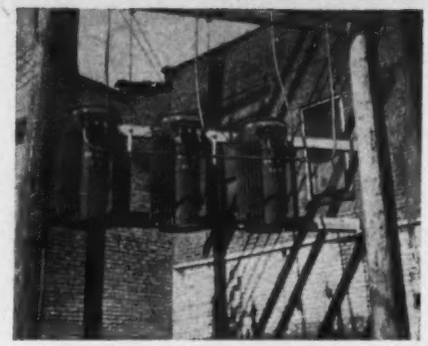
Several methods of cooling were considered: (1) The manifold could have been cooled normally by radiation and convection. This, however, would take considerable time. (2) Hot water spray might have been used, but it was felt that the cooling would be too rapid and dangerous stresses would be set up. (3) Exhaust steam at 2 to 3 lb. pressure could have been admitted to the manifold, but this method was but little safer than the use of water spray.

The manifold was cylindrical in shape with one turbine connection at each end and four connections on top for boilers.

•

Mounts Power Banks on Vertical Racks

A vertical steel or wood rack spanning two poles on 14-ft. spacing is used in preference to the conventional platform for mounting banks of up to four 100-kva. power transformers by the Wisconsin Public Service Corporation, Green Bay. This type rack, using a combination of 5- and 6-in. steel channels as main members, can be built in "normal" times for about



VERTICAL steel or wood racks used by Wisconsin utility, in preference to platform, support up to four 100-kv. transformers; low cost, improved appearance, ample strength cited as features

$27, but as a wartime conservation measure it has been redesigned to give equivalent strength using wood. Assembly drawings for both the wood and steel design are shown.

In the steel design the rack consists of two horizontal steel stringers approximately 14 ft. long, mounted one above the other on 3½-ft. centers and bolted to the poles by angle clips welded to the steel stringers. The top and bottom members are connected by three 2 x 2-in. steel angles. Top member of the rack is a single 6-in. ship channel. The bottom member consists of a 5-in. and a 6-in. channel welded together along their length with the two faces at right angles to each other, to give the necessary stiffness in the vertical and horizontal directions.

The wooden rack is similar in arrangement to the steel, but the top member is 4 x 12-in. fir and the bottom stringer 6 x 8-in. fir. They are connected by short 4 x 6-in. spacers 4 ft. 6 in. in length over-all. All wood parts are treated with preservative before assembly.

Transformers are suspended from the top member of the rack by conventional type transformer hangers.

How to Close, Trip Circuit Breakers

4. Fast-Reclosing Solenoid Mechanisms*

By G. J. EASLEY
Switchgear Engineer Westinghouse Electrical & Manufacturing Co., East Pittsburgh, Pa.

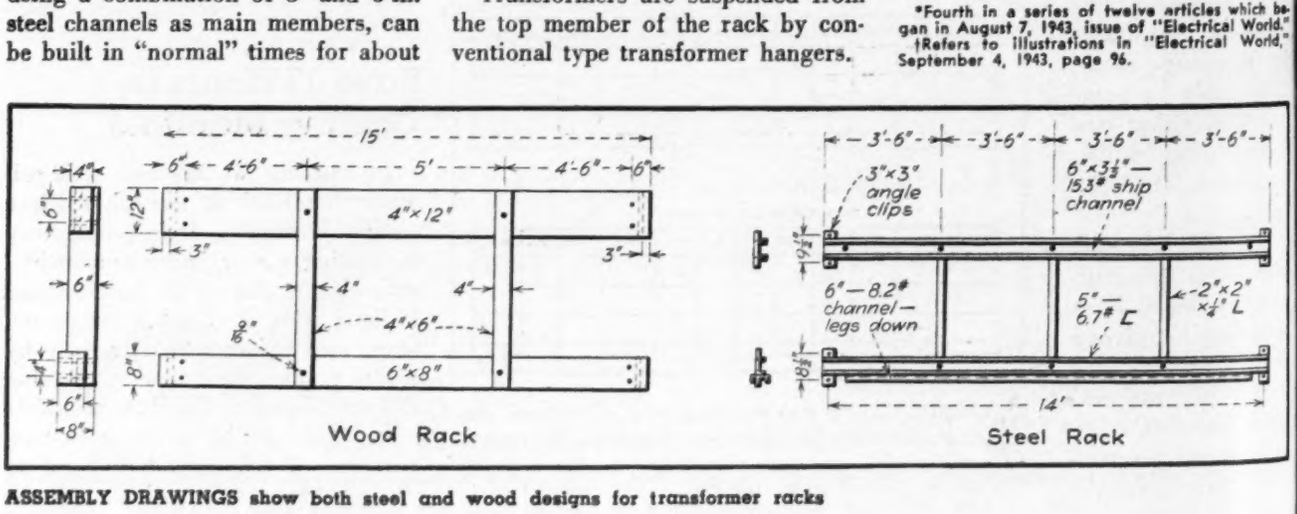
A type of solenoid which combines the advantages of both the trip-free and non-trip-free devices has been developed for fast-reclosing service. It has the double-lever arrangement of the trip-free mechanism, but trips free only when the breaker closes on a fault.

On a reclosing operation (OC) it acts the same as a non-trip-free unit and trips at the right end as shown in Fig. 1c.† Since the two levers remain latched together at the left end, the closing energy may be applied at any time during the opening stroke. If the fault still exists when the breaker recloses the mechanism is free to trip at the left end as shown in Fig. 1b,† the same as a trip-free mechanism.

Both latches are operated from the same trip coil, the latch at the left end being normally blocked. If the mechanism trips immediately after being closed (CO), the residual magnetic-leakage flux from the closing coil operates a magnetic interlock; this simultaneously removes the obstruction from the latch at the right end. Thus, any time the closing coil is able to cause a drag on opening, the mechanism is trip-free.

Because of the slow current build-up, it is impossible to obtain reclosing speeds lower than 30 cycles with this arrangement unless high currents are used; for this reason it has been generally superseded by the simpler pneumatic mechanism.

*Fourth in a series of twelve articles which began in August 7, 1943, issue of "Electrical World."
†Refers to illustrations in "Electrical World," September 4, 1943, page 96.



ASSEMBLY DRAWINGS show both steel and wood designs for transformer racks

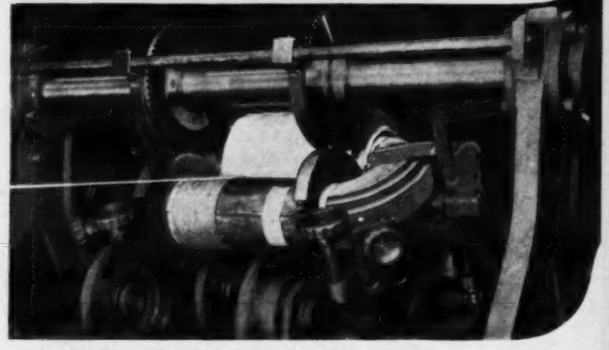
It's the way it's built

that makes the L-M ROUND-WOUND transformer a better transformer

1 *Continuous silicon strip steel in various widths makes possible a wound core.*

2 *Core, wound from uniform hot-rolled endless silicon strip steel, clamped ready for annealing.*

3 *Split gears are placed around insulation on each side of core preparatory to winding the round coils.*



4 *The round coils of the L-M ROUND-WOUND Transformer are wound directly on to the wound core.*

It offers you more because of its inherently correct design, fine materials, and superior production methods

1. *Better regulation at all power factors.*
2. *Better ratio of losses.*
3. *Uniformly low exciting current.*
4. *Uniformly high impulse strength.*
5. *High short-time over-load capacity.*

There are other modern distribution transformers, but no other distribution transformer is designed and built quite the same as the L-M ROUND-WOUND Transformer. . . L-M engineers have developed a method whereby they secure an inherently ideal combination of coil and core assembly. In addition, L-M ROUND-WOUND Transformers are being produced in the most modern manner. The resulting advantages to you are:

The L-M ROUND-WOUND Transformer is built in accordance with the new NEMA specifications and is available in 1½ to 25 Kva, 2400 to 7620 volts, ratings.

The story of the L-M ROUND-WOUND is told—with many pictures—in bulletin RW-421. Ask for your copy if you have not yet received one.

LINE MATERIAL COMPANY

HOW TO CLEAN UP SERVICES TO REDUCE SHORT CIRCUITS

Instructions issued by Cincinnati Gas & Electric Company within recent months, during a "clean-up campaign" on secondaries and services undertaken to eliminate troubles resulting from secondary and service short circuits, points to many things that can be done at little cost and less material to improve a portion of distribution circuits that seldom receives much maintenance attention. The following is take from the instructions to service crews. Most of th service troubles are from service wires which have t little separation or too much slack and become twiste together in trees to cause a short circuit. Proper spa ing and tension on service lines to prevent twistin arrived at by test, are shown.

SECONDARIES

Pull up secondaries where they are slack and add guys where necessary. Place spreaders on secondaries in places where trees can cause trouble.

SERVICES

Clearance—Check all servics for clearance from trees. If the tree can be trimmed to give fairly permanent clearance, this is the most desirable solution. However, if it is evident that the tree will soon grow into the service again, the service should be moved to the secondary and placed on a spreader. Where possible, a second service should be placed on the spreader in opposite direction to balance the tension. Caution should be used in placing services on spreaders on No. 6 secondaries.

Where neither of the above two solutions can be used to secure a service that is clear of trees, place a spreader on the service at the point of contact with the tree to prevent a short circuit.

Many services have been given excessive sag or tension to clear foreign wires. These services should be placed on attachments on the foreign pole and properly sagged. Where two or more services can be combined on one attachment, this should be done.

Sag and Spacing—Services should be pulled to the proper tension, shown, where the pole will support the load. For services more than 50 ft. in length the spacing between the wires at the service bracket should be 8 in. Be sure to place the brackets at the building far enough apart to provide *8-in. spacing between wires.* This requires the use of single-point brackets in place of three-point brackets on services more than 50 ft. in length. Wherever possible, house brackets should be placed vertically on the house. Services more than 100 ft. in length should have a spreader installed so as to prevent twisting.

Condition—Tape up small bare spots in otherwise good wire. Splice in pieces where only a few feet of wire is bad. Replace all wire where all of the insulation is bad.

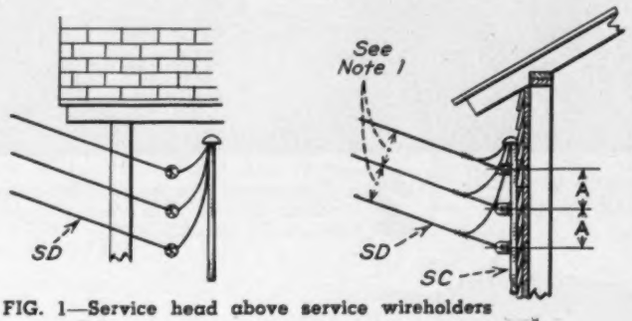


FIG. 1—Service head above service wireholders

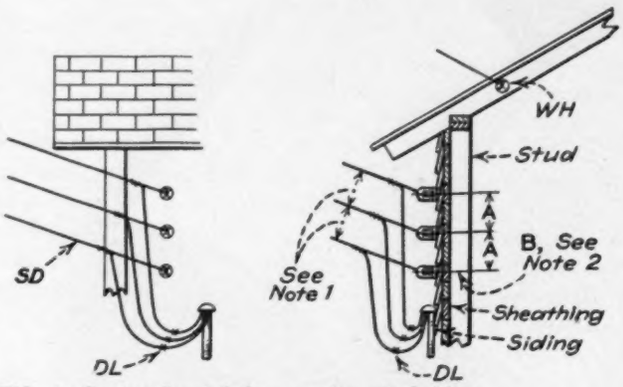


FIG. 2—Service head below service wireholders

NOTES

1. Dimension shall be such th conductor sepa tion is 8 in.
2. Drill 3/16-in. ¼-in. pilot hole prevent splitti boards.
3. Use seconda spreader when quired.
4. Use wirehold with longer scr when necessary.
5. For brick, dr ⅜-in. hole 2¼ deep for Rawlpl or ⅝-in. hole 2 in. deep for exp sion shield.

SD = servi drops. SC = se ice conduit or se ice entrance cab B = 11/32 in x 2 in. wood scr thread. WH = wi holders may be tached to verge facia board if

port is suitably reinforced. DL = drip loops shall be formed on the conduct entering a cable. If service entrance conductors are connected to a service dr above the service head, insulation shall be removed for ½ in. at the lowest po of the drip loop to provide drainage.

Sags and Tensions for No. 8 Triple Braid Waterproof
Medium Hard Drawn (MHD) and Soft Drawn (SD) Solid Copper

Temp., Deg. F.	Sag (In.) and Tension (Lb.) for Following Span Lengths									
	50 Ft.		75 Ft.		100 Ft.		125 Ft.		150 Ft	
	Sag	Tension	Sag	Tension	Sag	Tension	Sag	Tension	Sag	Ten
0	6	47	8	75	11	102	19	93	32	
30	8	34	11	56	15	77	23	77	36	
60	10	28	14	45	18	62	27	65	40	
90	12	24	17	38	21.5	54	31	58	44	
MHD*	12	178	19	247	27	308	38	342	53	
SD*	10	94	15.5	135	21	180	31	190	42	

* Loaded condition MHD = 15 deg. F., ½-in. ice, 8-lb. wind. SD = 15 deg. F., ¼-in. ice, 4-lb. w

VERYTHING YOU NEED

OR EVERY TYPE OF

Outdoor Lighting

Not only the latest, most efficient designs in standards and luminaires, but transformers, cutouts, relays, glassware, time switches . . . everything for effective outdoor lighting for street, highway, or sports. Write to Main Offices, Milwaukee, Wisconsin, for outdoor lighting information.

LINE MATERIAL COMPANY

Relaying Lines Added for "Big Inch" Pumps

By H. A. P. LANGSTAFF
Electrical Engineer
West Penn Power Company, Pittsburgh, Pa.

Required changes and additions to the West Penn system to provide for power service to two pumping stations of the "Big Inch" oil pipe line (see ELECTRICAL WORLD, July 24, 1943) comprised three extensions. One (A on Fig. 1) was occasioned by pumping station No. 20 because lines in that area were already loaded to the limit by coal-mining loads; another (B) was a 25-kv., 12-mile circuit.

No sectionalizing facilities other than removable jumpers will be provided for the 132-kv. tap marked A. The Clarksville end will have a 132-kv. air-brake switch. Two fully automatic reclosing oil circuit breakers will control the two outgoing 25-kv. circuits. The 25-kv. neutral of the transformer bank at Clarksville is grounded through a 19-ohm resistor.

The Lake Lynn-Charleroi lines are protected by carrier-current relays with directional overload relay back-up protection. Clarksville substation relaying will be co-ordinated therewith; impedance networks connected to the condenser bushings on the 132-kv. side of the transformers will act as a 132-kv. ground fault detector. A tap connection to one of the high-tension bushings will serve as a capacitor connection for the relay transreceiver set. Clarksville substation will be included in the carrier-current protected area, so that in case of 132-kv. fault on line or transformer bank the 132-kv. breakers at Lynn and Charleroi and the two 25-kv. breakers at Clarksville will be instantly cleared by carrier relays. The 132-kv. line, the transformer bank and the 25-kv. bus are immediately re-energized by the automatic reclosing of the 132-kv. breaker at Charleroi. If trouble has cleared, the breaker at Lake Lynn is closed and the two 25-kv. breakers at Clarksville

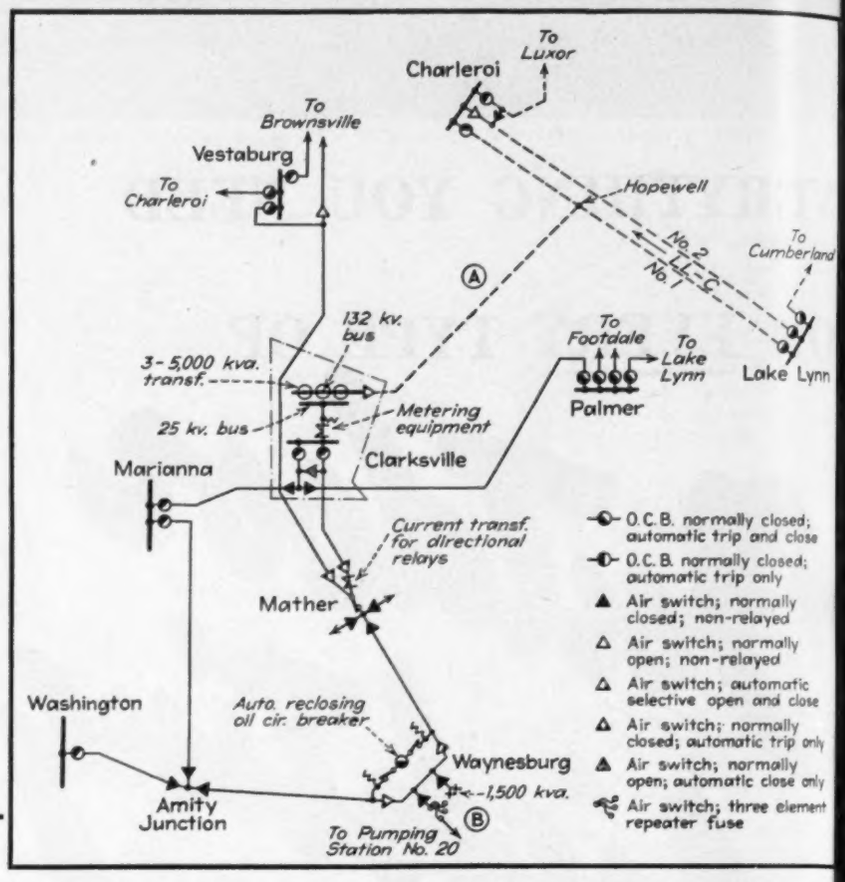


FIG. 1—Protective features applied to 132-kv. tap (A) and 25-kv. extension (B) to serve one of WEP'S "Big Inch" pumping stations

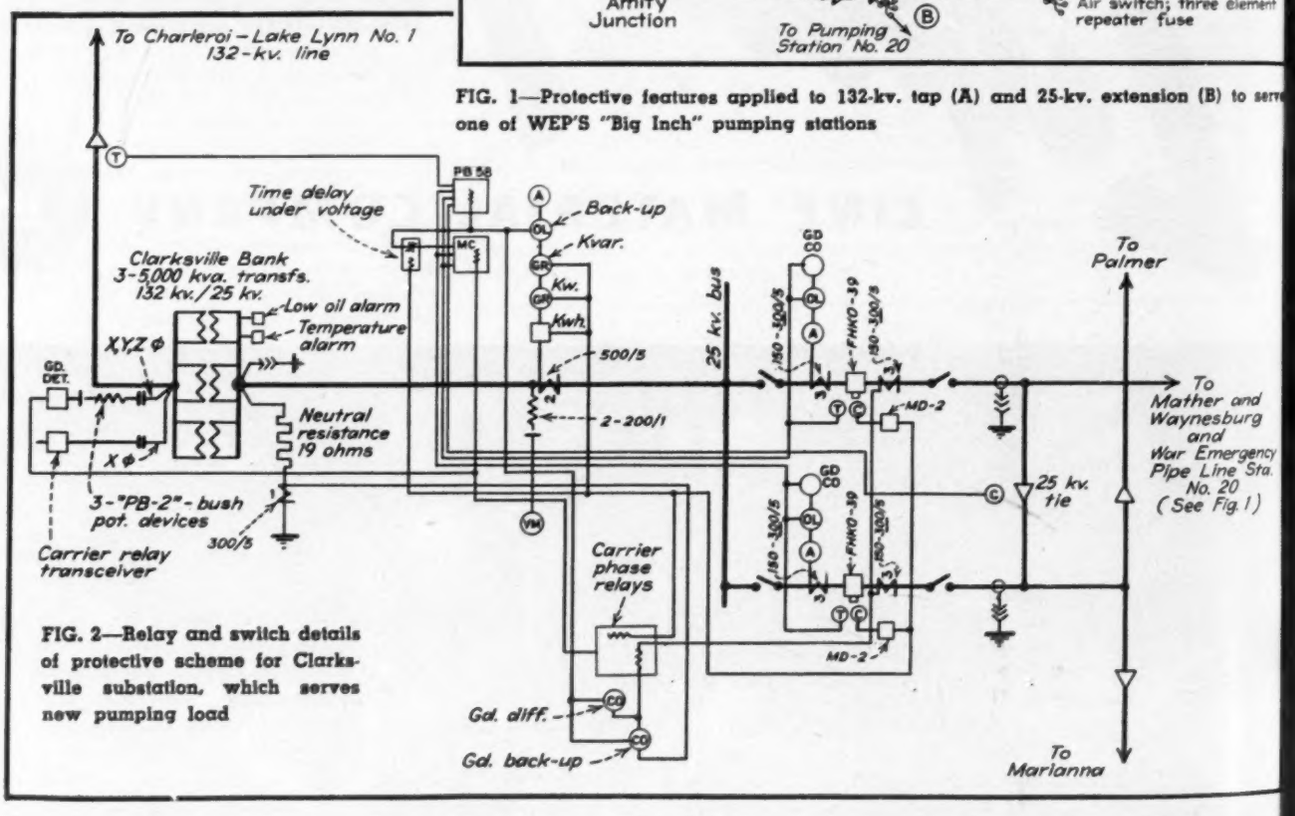
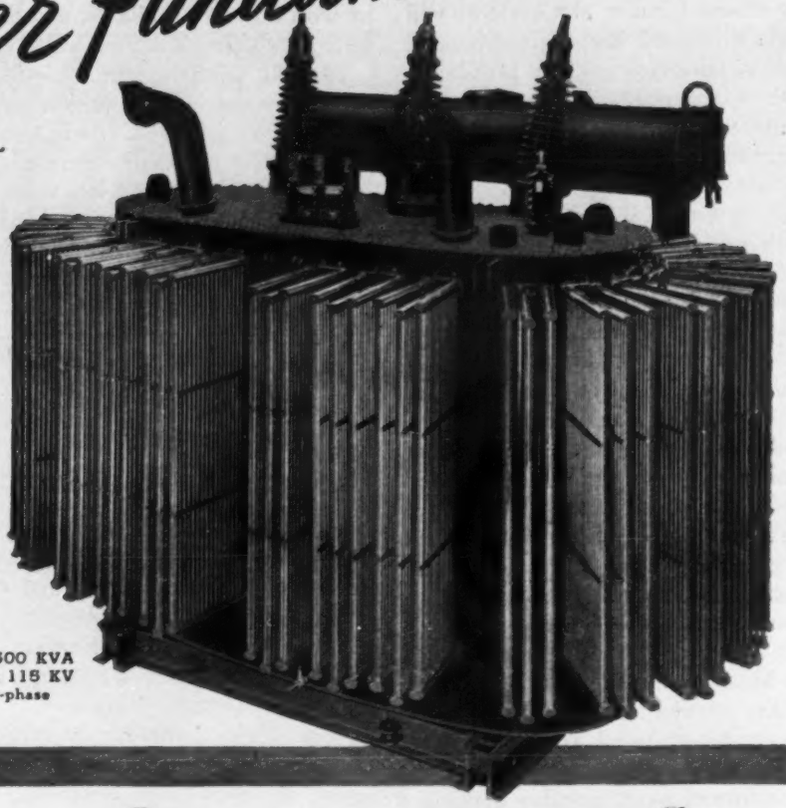


FIG. 2—Relay and switch details of protective scheme for Clarksville substation, which serves new pumping load

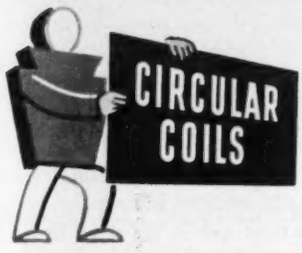
Transformer Fundamentals

...that insure unfailing power supply to *war industries.*

The fundamental improvements outlined below are the result of Pennsylvania's continuous research and development to assure greater transformer reliability, lower operating costs and longer life! They are but a few of the many improvements to be found in Pennsylvania Transformers.



23,500 KVA
55°, 115 KV
3-phase



. . . Possess Maximum Inherent Strength

In a circular coil the tension of each turn of wire is uniform throughout its length. No coil of any other shape possesses this quality.

The turns in a circular coil are wound tightly without excessive tension on the wire —thus eliminating the possibility of stretching the winding and injuring the insulation. This added safety is inherent in Pennsylvania's circular coil construction.

. . . to withstand short circuits

All coils of the helical and pancake type are precompressed to such an extent that no further compression can take place under the most severe short circuit. This definitely precludes any possibility of the coil stack moving or distorting under short circuit.

The ability of the coil to maintain its shape under the prescribed pressure is your guarantee that the transformer will withstand short circuits.

. . . with Silver-to-Silver Contacts

Pennsylvania's straight line tap changer with its silver-to-silver contacts is capable of carrying heavy overloads without overheating and is able to withstand "dead" short circuits without detrimental effects.

Tests have been made to fully prove these characteristics, the tap changer being subjected to 100,000 full operations—more than would occur during the normal life of the transformer.

Pennsylvania TRANSFORMERS

Pennsylvania TRANSFORMER COMPANY

808 RIDGE AVENUE, • N. S., PITTSBURGH, PA.

automatically close, thereby re-establishing the entire system to normal within a comparatively few seconds. Should the trouble remain, the initially closed breaker at Charleroi will again trip and the motor-operated 132-kv. air-break switch at Clarksville will open, disconnecting the transformer bank; simultaneously a motor-operated air-break switch will close, tieing the two 25-kv. circuits together on the line side of the automatic oil circuit breakers.

Another attempt is made to re-energize the 132-kv. line. Should this connection prove satisfactory an operator is sent to Clarksville substation to examine the equipment, and if all checks O.K. an attempt will be made to re-energize the transformer bank by closing the motor-operated air-break switch.

In the case of 25-kv. station fault to ground the two 25-kv. oil circuit breakers immediately open, thereby disconnecting the 25-kv. system from the fault; the 25-kv. motor-operated air-break switch closes, tieing the two 25-kv. circuits together, and the 132-kv. motor-operated air-break switch clears the high-tension side of the transformer bank, possibly opening a limited amount of fault current.

Throw-over Control

At Waynesburg a 1,500-kva. bank is at present controlled by spring-operated air-break switches, providing what is called a throw-over type of control. The two air-break switches will now be motor operated and a used fully automatic reclosing oil circuit breaker will connect the two 25-kv. circuits together and be relayed in such a manner that this breaker will automatically open on faults on either side of this station. Its main object is to normally make use of all available copper. One motor-operated air-break switch will normally be closed and the other open. A fault on one line, the airswitch of which is closed, will first result in the opening of the 25-kv. oil breaker. An attempt will automatically be made to re-energize the faulted line, and if successful the oil breaker will reclose, restoring service to normal. If the attempt is unsuccessful the oil breaker will remain open, the closed airswitch will automatically open and the open airswitch will automatically close, restoring service to the Waynesburg 25-kv. bus. This combination of an automatic tie oil circuit breaker together with two automatic airswitches will result in the Waynesburg 25-kv. bus being energized whenever either or both lines are available, and thereby keep all circuit copper working.

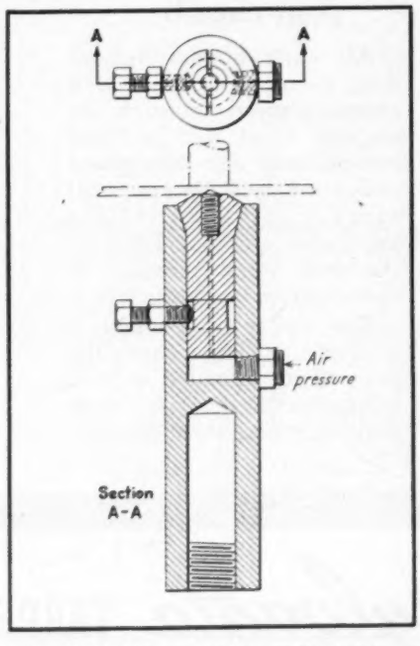
No. 20 pumping station will be served by the 12-mile, 25-kv. circuit B out of Waynesburg. It will be controlled by a manually operated air-break switch and 34.5-kv. three-element repeater fuses. Should load conditions demand, these may later be replaced by a fully automatic reclosing oil circuit breaker with the airswitch acting as a by-pass.

•

Device Improves Projection Welding

A device which makes practically fool-proof the projection welding of steel studs on metal hinges and sheet metal surfaces has been developed by Andrew Campriello, a foreman and spot welding expert at General Electric's Schenectady Works.

The device calls for a vertically milled slot in the collet, which is located in the bottom electrode. The collet is tapered. When the stud is introduced in the collet and the upper electrode is depressed the jaws of the collet close tightly about the stud. The resulting pressure causes the current to be distributed evenly on all sides, and at the top of the stud near the welding zone rather than through the entire stud and then to the sheet.



ELECTRODE for projection weld studs

Below the collet is a space for air, forced in under pressure by a hose. As soon as the welding is complete and the upper electrode lifted the air pressure forces the tapered collet upward. The collet expands and releases the stud. "Binding" of the stud on release was formerly a problem.

When the collet reaches a height sufficient to release the stud its movement is stopped by a setscrew which engages the bottom of the collet.

•

How a Fuller's Earth Filter Purifies Oil

By HOBART E. ROWE
University City, Mo.

Insulating oil may be treated with fuller's earth in two ways:

1. It may be agitated with fuller's earth in a tank and passed through a blotter press to remove the clay from the oil, which is essentially a batch process.

2. A more practical way is to pump the oil through a filter having a cartridge of fuller's earth, which may be done as a continuous process.

Results accomplished by the use of a fuller's earth filter are as follows:

1. All sludge is removed from the oil, including dust, coarse carbon, colloidal sludge.

2. Organic acids and soluble sludge are removed from the oil even though they are in solution in the oil.

3. Acidity of the oil is restored to a value as low as or lower than the oil had when new.

4. Emulsification resistance of the oil is restored to its original value.

5. Subsequent rate of deterioration is reduced to that of new oil.

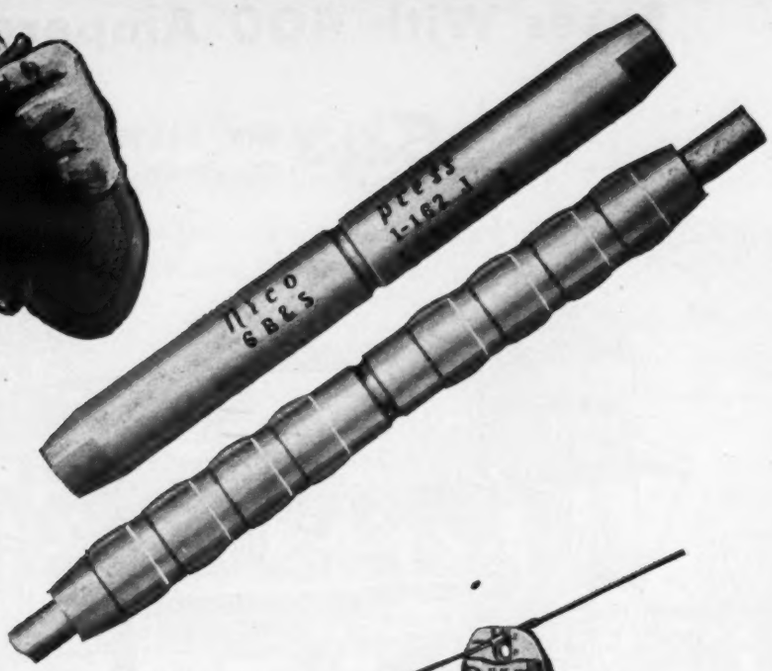
Limitations of the fuller's earth filter:

1. To all practical purposes it will not remove water from oil. The small amount of water which fuller's earth will remove is practically negligible. Manufacturers of such presses recommend that the oil be subsequently passed through a blotter press.

2. Power is required for the pump and heaters.

Characteristics of the blotter filter press and the centrifuge were outlined in the August 21 and September 4, 1943, issues of ELECTRICAL WORLD. Similar information on activated alumina will be presented in a subsequent issue.

"You Can't Beat
Nicopress
for Strong–Tight–Neat Splices"



IMPORTANT? Most certainly. Those line splices are vitally important to the service of the entire line. One poor joint means trouble. When you use the Nicopress Compression Method of Splicing you're sure that all joints are uniform—that each splice equals or exceeds the rated breaking strength of the conductors . . . and that Nicopress Splices have a lasting high conductivity.

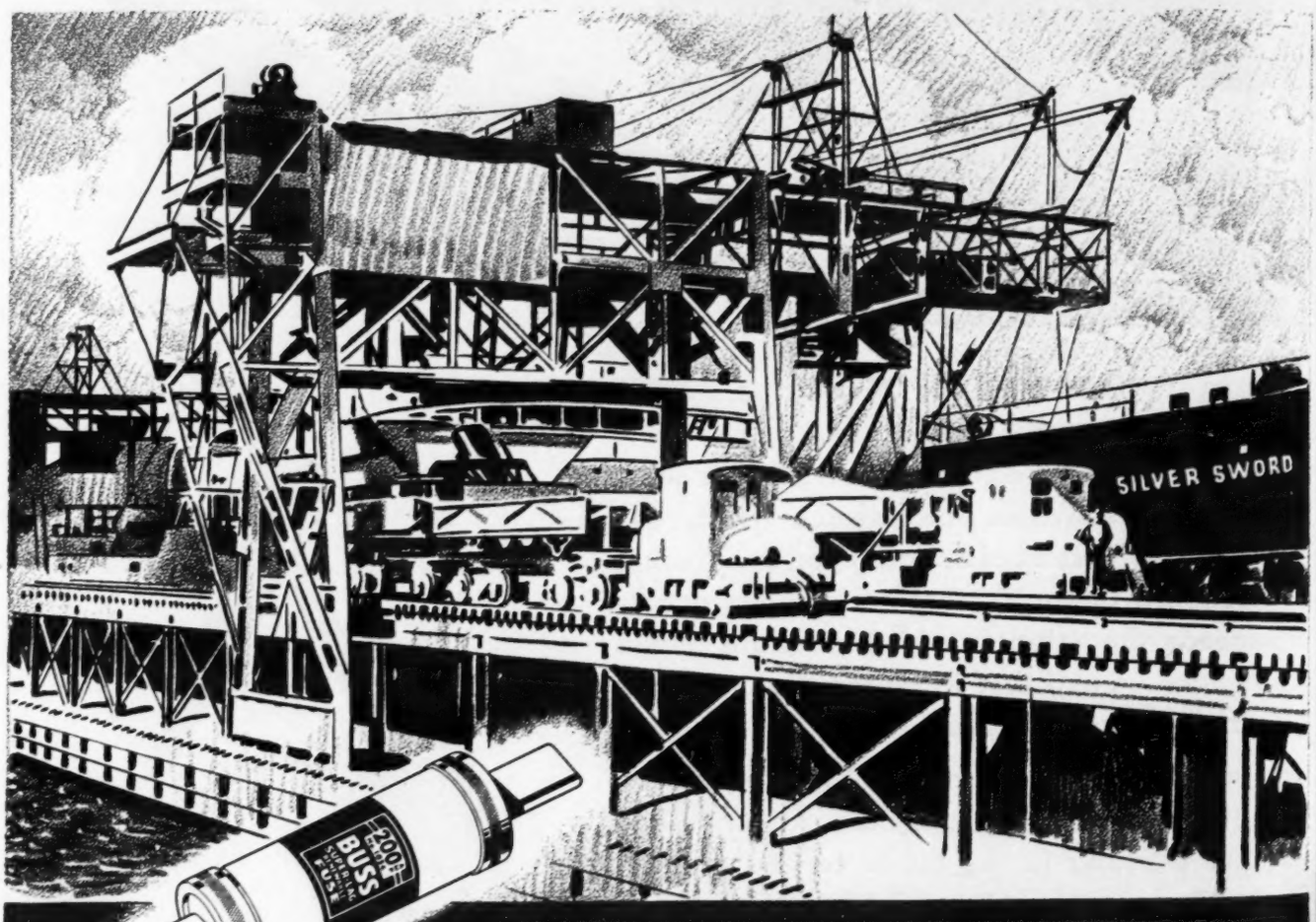
One reason why linemen like Nicopress is because they know these joints are quickly made whether working in the air or on the ground. Order Nicopress from your Jobber.

THE NATIONAL TELEPHONE SUPPLY COMPANY
Manufacturer of Specialties for Power and Communication Lines
5100 SUPERIOR AVENUE • • CLEVELAND, OHIO
Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA
Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

"We Got Rid of Costly Shutdowns

On Our Cranes—And Stopped Shorts From Burning Up Our Heavy Copper Trolley Wire, When We Replaced 600 Ampere Fuses With 400 Ampere BUSS Fuses."

Says **MR. STANLEY REISLER, Supt. of Elec. Dept.**
Davison Chemical Corp., Baltimore, Md.



Gantry crane at Davison Chemical Corporation, Baltimore, Maryland protected by BUSS Super-Lag Fuses.

BUSS Super-Lag

"The value of BUSS Super-Lag fuses is of greater importance today than ever before, because of the scarcity of copper trolley wire, and the need to make every minute, hour, and day count. We must keep the working crew, who depend on our cranes to handle material for them, on the job.

"We started to use 400 ampere BUSS Super-Lag fuses over 12 years ago, replacing 600 and 800 ampere fuses in the main feeders to our cranes.

"We found that BUSS fuses not only eliminated useless shutdowns, caused when a momentary overload occurred—but, when a trolley wire broke, the 400 ampere BUSS Super-Lag fuse blew instantly when the broken wire shorted on the others. There was hardly a mar on the other wires.

"Before swinging to BUSS, such shorts often burned out the entire set of wires, which had to be replaced—tying up our cranes for 3 or 4 days for this major repair job. We're certainly sold on BUSS Super-Lag fuses."

STANLEY REISLER, *Supt. of Elec. Dept.*
Davison Chemical Corp., Baltimore, Maryland

Are You Tolerating *Useless* Waste of Time and Material Because of Fuse Failures?

In Davison's plant—as in thousands of others—the long time-lag of BUSS fuses prevented them from opening on momentary or harmless overloads.

In an effort to prevent useless shutdowns with other fuses, Davison tried 600 to 800 ampere fuses. But even with these large size fuses they still had many needless blows. Protection was sacrificed to such an extent that on short-circuits trolley wires were frequently badly damaged before the fuses would blow.

400 Ampere BUSS Super-Lag fuses solved Davison's problem because they were able to withstand momentary surges, yet the smaller size opened instantly when there was real danger caused by a shorted wire.

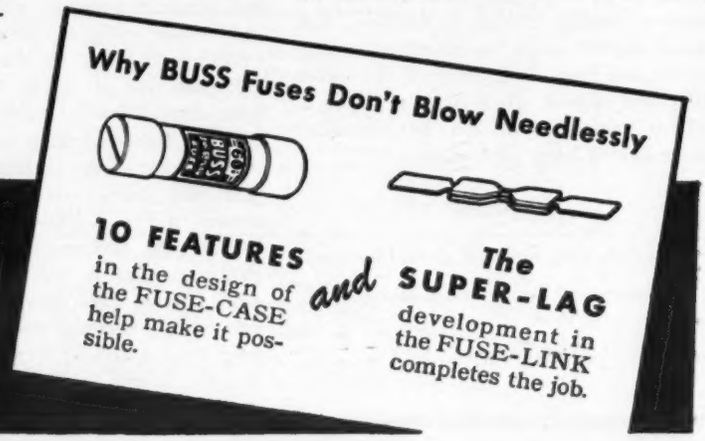
Here's Why BUSS Super-Lag Fuses Greatly Reduce or Entirely Prevent Needless Blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus, excessive heat which causes fuses to blow when they should not is prevented.

The fuse link used is the famous "BUSS SUPER-LAG." It has lag-plates attached which give it a long time-lag so that heavy starting currents or other harmless overloads will not cause the fuse to blow.

And Here Is How to Solve the "Shut-down Problem" in Your Own Plant

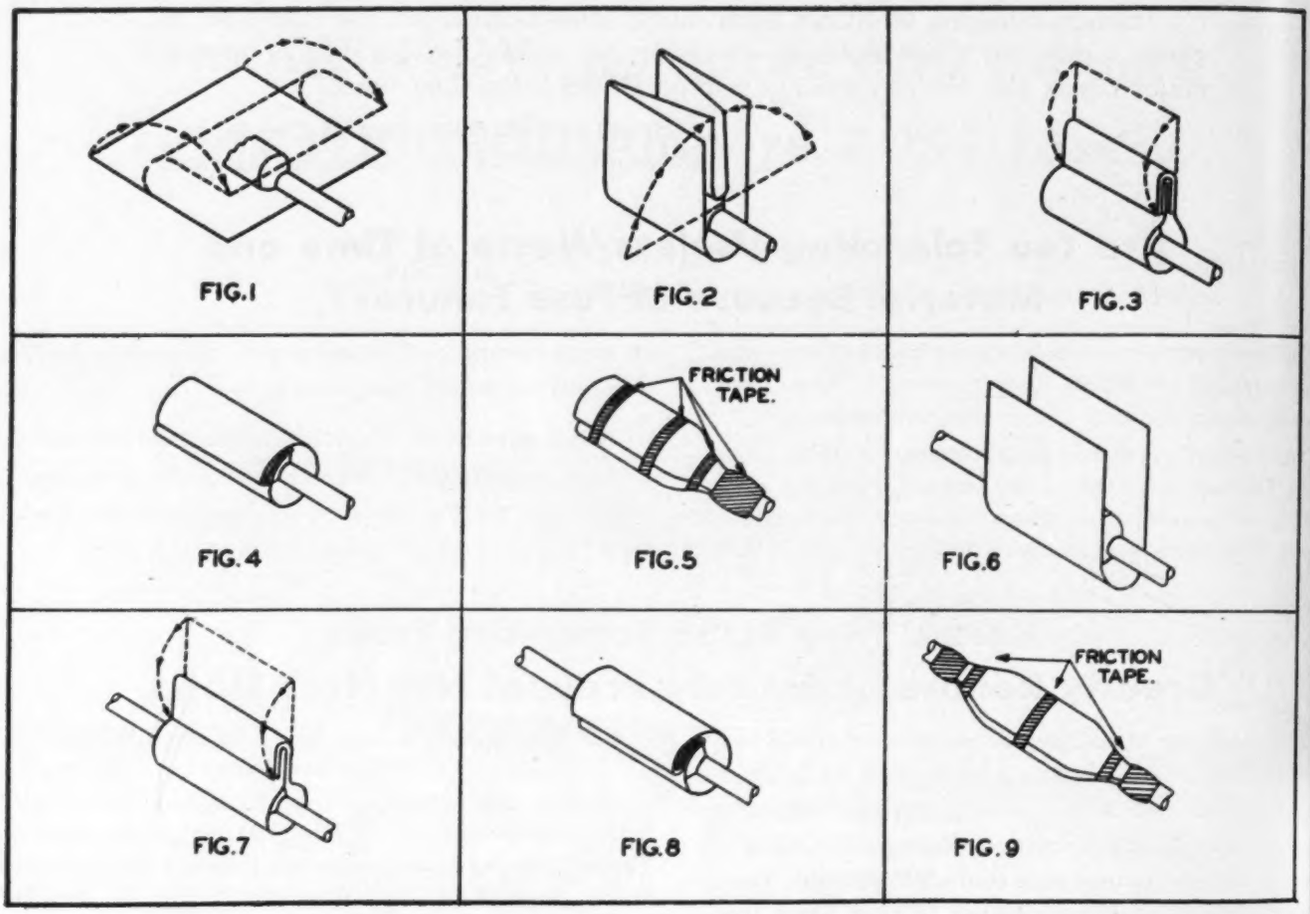
Be sure that all purchase records dealing with circuit protective devices call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses assure. BUSSMANN MANUFACTURING COMPANY, *Division McGraw Electric Company*, University at Jefferson, St. Louis, Missouri.


Why BUSS Fuses Don't Blow Needlessly
10 FEATURES
in the design of the FUSE-CASE help make it possible.
and
The SUPER-LAG
development in the FUSE-LINK completes the job.

FUSES

HOW TO APPLY WATERPROOF TARPAULIN TO CABLE JOINTS

A method for the protection of exposed cable parts, as outlined below, adapted from transmission and distribution department construction standards of Boston Edison Company



Parts of an underground cable or joint temporarily exposed to dripping water should be protected by applying a waterproof crepe tarpaulin. This will not insure protection against immersion, and water should never be permitted to rise above any part of the cable from which the lead sheath or sleeve is removed. These tarpaulins should be discarded after having been used once.

MATERIAL

The following material should be used:

1 waterproof crepe tarpaulin 2½ ft. square.

1 roll of friction tape.

AT END OF JOINT OR CABLE

Hold the tarpaulin so that the crepe is at right angles to the axis of the cable and place it beneath, with the exposed end of the cable or joint in its center, folding over once as shown in Fig. 1. Lift each side as in Fig. 2 and align the four edges. The four thicknesses should then be folded along a line half way to the surface of the sheath or sleeve so that the edges are just touching as shown in Fig. 3. Then make a second fold at the surface, stretching the tarpaulin so that it fits tightly, and bind with friction tape. Build a small pyramid of tape over the end of the tarpaulin (see Figs. 4 and 5).

After applying the tarpaulin, bend the protected end of the cable slightly upward so that water cannot run into it from along the cable.

AT AN OPENING IN A SLEEVE OR SHEATH

Place the tarpaulin around the joint or cable with the crepe parallel to the axis as shown in Fig. 6. The two sides should be evened and then folded along a line half way to the surface of the sleeve or sheath (see Fig. 7). Then make a second fold at the surface, stretching the tarpaulin so that it fits tightly and bind with friction tape. Build a small pyramid of tape over the two ends of the tarpaulin (see Figs. 8 and 9).

Here are the NEW

certified FLEUR-O-LIERS

...with more to come

GRUBER
ENDER
SUN-LITE
CURTIS
WAKEFIELD
LEADER
TRU-AD
LIGHT CONTROL
WILEY
A. L. SMITH
ELECTRO
WILLIAMS
MITCHELL
EASTERN
Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps.
Electrical Testing Laboratories, Inc.
NEW YORK, N. Y.
A COPY OF THIS CERTIFICATE SHOULD APPEAR UPON EACH UNIT OR PACKAGE
E.T.L.
E.T.L.
FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 95% POWER FACTOR

When you specify fluorescent lighting fixtures, get the protection this label gives.

Shown here are some of the TESTED, CERTIFIED, GUARANTEED FLEUR-O-LIERS. Models of other FLEUR-O-LIER Manufacturers are now in the testing laboratories and will be released shortly.

Many sources of supply...and extra protection for YOU!

The big idea back of FLEUR-O-LIER is protection *for you.* It's a practical, helpful program that has already served scores of war plants. Many leading fluorescent fixture makers participate.

The Fleur-O-Lier *label* on a unit tells you at a glance that this product was *Tested* by impartial, independent Electrical Testing Laboratories, Inc., New York; *Certified* by them as meeting 50 definite standards set up by Mazda lamp manufacturers; and checked again at the factory four times a year by E. T. L.

Fleur-O-Lier standards cover all important features for good lighting *performance* and *service* as well as WPB and Bureau of Standards requirements. And you get many PLUS features provided by individual makers.

Wherever you're located, there's a Fleur-O-Lier Manufacturer not far away. Leading jobbers sell Fleur-O-Liers. You can get Fleur-O-Liers on suitable WPB priorities.

NEW! Write now for booklet containing complete FLEUR-O-LIER engineering specifications Reprinted to include information on lightweight channels. You'll want this book when you specify fluorescent installations. With it you get the FLEUR-O-LIER story and list of manufacturers. Address FLEUR-O-LIER MANUFACTURERS, 2126-9 Keith Bldg., Cleveland 15, Ohio.

FLEUR-O-LIER

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

Electric Heater Aids Fire Hose Drying

A simple and effective method of keeping its fire hose in good working condition by making periodic tests and putting the hose through a washing and drying process is employed by the Consolidated Edison Company of New York, Inc. All of the linen unlined standard 1½ and 2½-in., 50-ft. length hose installed for fire protection in the generating stations, substations and gas plants undergoes this routine rejuvenating process once a year, or after any of the other regular inspections in which hose appears to be worn or dried out. Hose lengths in commercial buildings, which are inspected at regular intervals, are also subjected to this treatment if their appearance warrants.

Reconditioning is carried on at the 66th Street generating station in Brooklyn. On a washing platform, which accommodates three full lengths, the hose is first tested by 75-lb. hydrostatic pressure to discover defects. Areas with pinholes or leaks are cut from the hose and the couplings are replaced on the remaining good lengths (provided they measure at least 15 ft.). The hose is scrubbed with a light brush, using warm water and a good grade of soap, then rinsed inside and out, and hung up to dry. One end of the hose length is hauled to a rail 50 ft. above the special heater, or drying rack, which has been devised for this use. The lower end of each length is attached to a coupling on top of the rack, through which warm air from the heating compartment is circulated through the hose lengths, assisted by compressed air introduced at the base of the hose.

The heater is constructed of sheet metal, has two compartments, each of which is approximately 3 ft. high, 18 in. wide and 5 ft. long. On the top of each compartment are eight couplings to which the standard 2½-in. hose can be connected. (By substituting smaller couplings, 1½-in. hose can be attached). Heat for drying the hose is provided by two 1,500-watt heating elements in each compartment. Compressed air, piped into the compartments from the station's regular compressed air line, blows the warm air up through the couplings into the hose. A pressure of 80 lb. is used to inflate the hose, this being reduced to 2 lb. during the drying period. Three-quarters of the hose dries in eight hours, after which the hose is reversed and the other end is coupled to the drying rack for another four hours. The hose is then thoroughly dry and is taken down and stenciled with date and length.

Three employees generally handle the job, processing about 16 lengths of hose in a day. Some of the pinhole leaks which show up in the initial water test under 75 lb. pressure disappear when subjected to a slightly increased pressure.

ELECTRIC HEATER dries sixteen 50-ft. lengths of 2½-in. hose at one time. Heater door is open, showing the two 1,500-watt heating elements in the front compartment. Ignazio Emanuelo is in charge of the process

•

How to Keep Inertaire Effective

By S. BENNON
Transformer Engineer
Westinghouse Electric & Manufacturing Company, Sharon, Pa.

Oxygen and moisture are excluded in Inertaire transformers by an automatically regulated atmosphere of dry and inert nitrogen maintained above the transformer oil. Specific items for maintenance are presented.

Change of Cylinders—To keep the Inertaire effective the nitrogen cylinder must be changed when it becomes depleted. When the pressure drops to a value of 150 to 200 psi. it should have attention. Normal time for depletion of a nitrogen cylinder is six months to a year. In any particular installation the exact period will depend upon the load and ambient temperature cycle to which the transformer is subjected.

In the type RV equipment the cylinder should be immediately replaced with a new cylinder. In the type RB equipment the reducing valve may be left hanging on its chain with its protecting cap in place while the cylinder is being refilled. Air Reduction Sales Company, with offices in Pittsburgh, Philadelphia, Jersey City and Chicago, refills cylinders or furnishes new ones; Stewart Oxygen Company of San Francisco serves in the west.

Leaks—If the load and temperature of the transformer are approximately constant there will be no variation in oil volume; consequently there should be no change of pressure inside the tank. If the pressure drops rapidly and the nitrogen inlet valve operates frequently it indicates the presence of a leak. All gasketed joints should be checked carefully.

Relief Diaphragm—The diaphragm can be inspected by removing the screw cap over the inspection opening. If for any reason the diaphragm ruptures it should be replaced at once.

•

Air Siren Built by Idaho Power Company

The Idaho Power Company is rather proud of its new air siren built by company technicians; J. F. Emery, assistant electrical superintendent, and Leonard Walker designed it. It has been described as being "built like a tuba and fed by compressed air chopped up and expelled in pieces."

Many air sirens pump their own air. But it was found that they either did not have sufficient volume or could not be controlled in short and long blasts to include alert, blackout and clear signals. In this one compressed air from an outside source is introduced, the supply remotely controlled from the dispatcher's desk by an electrically operated valve, so that the code signals may be made by

SOUND ENGINEERING ADVICE

✓ *Design* in TIMBER

✓ *Specify* TECO CONNECTORS

✓ *Employ* a Teco Timber Fabricator

'Round the World—100,000 timber war and peacetime structures have been quickly and economically built with the TECO Timber Connector System of Construction—sponsored by the lumber industry since 1933.

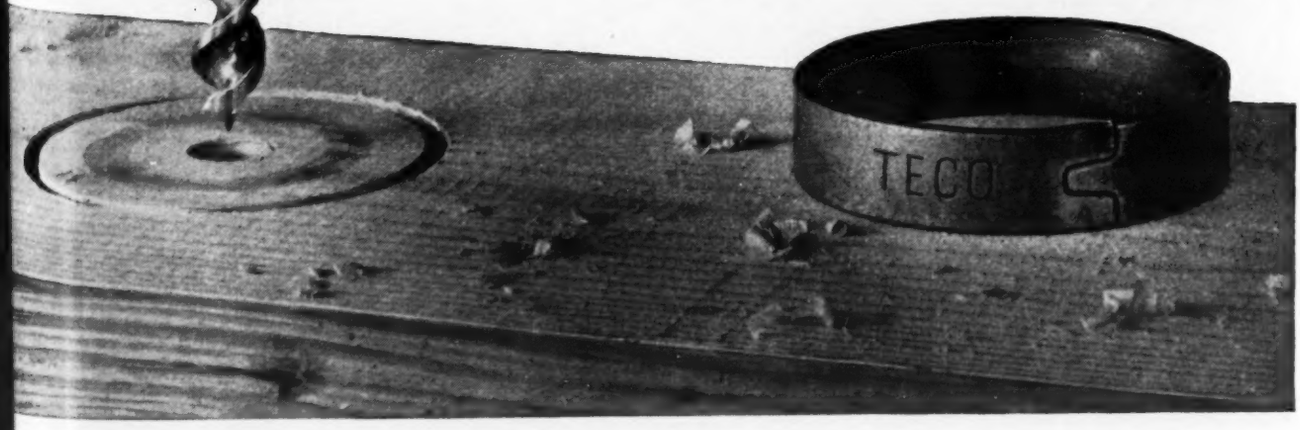
The TECO Split-Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.

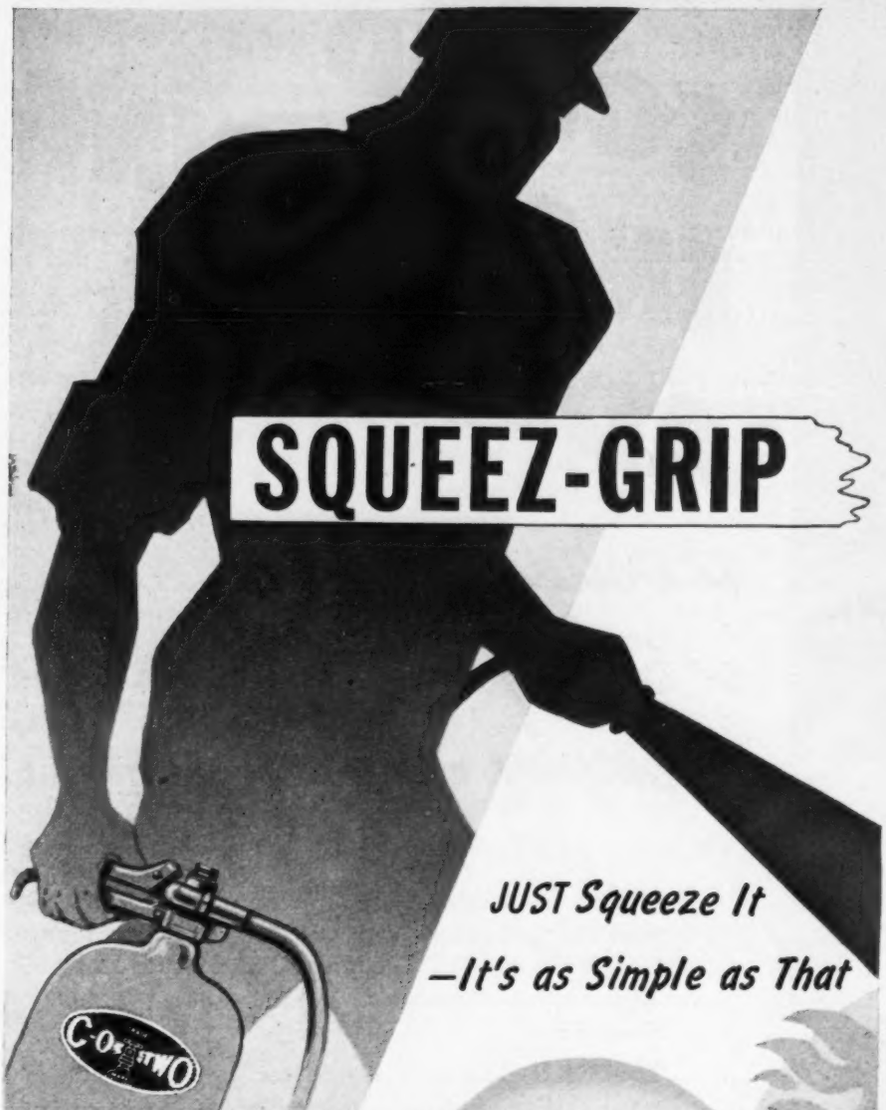
Write for FREE copy of "Heavy Timber Construction Details"—just off the press. Always specify TECO Connectors.

TIMBER ENGINEERING COMPANY

NATIONAL MANUFACTURERS OF **TECO** *TIMBER CONNECTORS AND TOOLS*

WASHINGTON, D. C. PORTLAND, OREGON





The SQUEEZ-GRIP valve is a development so sensational, and of such great importance, that it actually changes the idea of what constitutes speed in fire fighting. It ends the delay, the waste motion of setting down an extinguisher to operate a "hand-wheel" valve.

NEW SQUEEZ-GRIP SAVES TIME AND GAS

With this new C-O-TWO release valve the operator merely closes his hand to operate the release lever, just above the carrying handle, and carbon dioxide gas, the fastest non-damaging fire extinguishing agent, is released against the fire in split seconds. Time is saved . . . gas is saved. Even while carrying a fifteen pound extinguisher, C-O-TWO gas can be discharged and shut off as quickly as the hand is closed and opened. The New SQUEEZ-GRIP is the most modern contribution to fire protection. It's Safer because It's Faster.

C-O-TWO is a registered trademark and corporate name of this company. C-O-TWO is inspected and labeled by the Underwriters' Laboratories; approved by Factory Mutuals and the Bureau of Marine Inspection and Navigation. To be safe specify C-O-TWO.

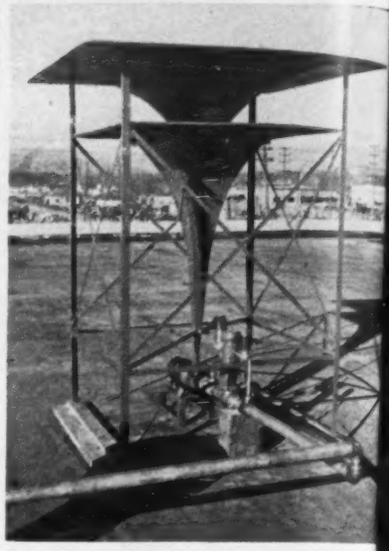
C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1, NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

opening and closing the air supply valve. In ordinary operation, four times a day, a Telechron timer is used, located in the service building.

Air is released through only one port and the special type of double horn puts the sound out horizontally rather than vertically. The operating sound unit is a flanged wheel with teeth cut in the edge, which fits tightly in a steel cylinder. The wheel is revolved by an electric motor. The interior of the cylinder is filled with



COMPRESSED-AIR-OPERATED SIREN with double horn, so that the sound tends to spread out horizontally; a heater keeps ice and snow from collecting in the mechanism in winter

high-pressure compressed air, which escapes through the port whenever the spaces between the teeth coincide with the port. The wheel is rotated at such a speed that the air is released 45 times a minute. The sound comes out of the lower horn and spreads out between that and the upper horn. An electrical heating unit housed in a box surrounding the mechanism keeps frost and ice from collecting in the mechanism in winter.

The length of time for which it will operate continuously is about five minutes with the present air storage capacity. In operation the siren takes approximately 200 cu. ft. The sound of the siren is one million times the threshold of audibility or the slightest sound that may be heard. This is beyond what the engineers call the threshold of feeling. Persons who have stood near it when it is blown say that the sound hurts the chest as if some one were standing on it.

How can you get men to trouble spots faster?

(It's easy)

The answer is—RCA radio.

Used like RCA police radio.

The idea is this: You install RCA radio at your headquarters and on your service or emergency trucks.

That enables you to have your truck crews report to headquarters periodically, by radio.

And—when trouble happens overhead or underground—your headquarters men can transmit instructions instantly by radio to the truck nearest the spot.

This idea was rapidly gaining acceptance until war came. Now, of course, RCA manufacturing plants are working to capacity night and day producing radio equipment to help fight Nazis and Japs.

But in RCA laboratories the work goes on. And just as soon as war conditions permit, RCA will supply your emergency men with better radio equipment and service than ever before. *RCA Victor Division, Radio Corporation of America, Camden, N. J.*

RCA EMERGENCY COMMUNICATIONS EQUIPMENT

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

WHAT DO YOU KNOW ABOUT— Glass?

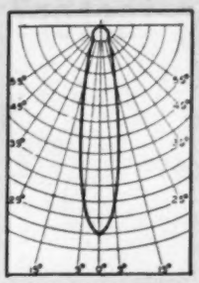
Industrialists, with lighting problems are looking to silvered-glass reflectors for the answer. PERMAFLECTORS – the silvered-glass reflectors with the **permanent** reflecting surface – offer many advantages:

Fact One PERMAFLECTORS are highly-efficient **shaped mirrors**. They pick up the maximum flux of light and deliver it where it is needed and wanted. They provide engineered light control in desired concentrated, medium, or broad distribution.

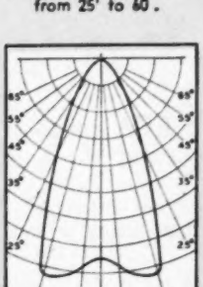
Fact Two PERMAFLECTORS permit a wide range of mountings – from 6 to 60 feet, (and more), above floor level – on side walls – or on the work itself – for General, Directional, or Localized Lighting. Simply, inexpensively installed.

Fact Three PERMAFLECTORS will not rust. They are moisture and heat resistant. The silvered reflecting surface will not check, crack, or peel. When properly installed, PERMAFLECTORS will give a longer period of more efficient, more economical service.

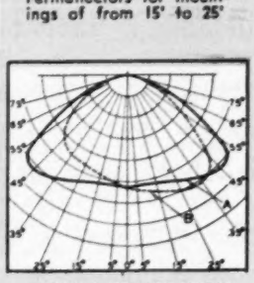
Investigate PERMAFLECTORS for your next lighting job. Write to Permaflector engineering headquarters at Pittsburgh, or let us send our representative to see you.



CONCENTRATED DISTRIBUTION Permaflectors for high mountings—from 25' to 60'.



MEDIUM DISTRIBUTION Permaflectors for mountings of from 15' to 25'



BROAD DISTRIBUTION Permaflectors for "horizon" mounting, 15' or less from floor.

PITTSBURGH REFLECTOR CO.

OLIVER BLDG. PITTSBURGH, PA.

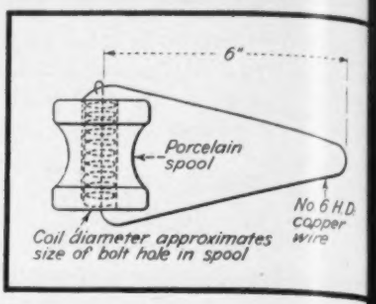
Please rush complete data on Permaflector Industrial Lighting Units. EW-9-43

NAME.....

ADDRESS.....

CITY..... STATE.....

Service Attachment



Above is a low-cost type of hou service attachment developed a used on the system of the Louisvi Gas & Electric Company. The devi is made up from readily available m terials in the company's own shop During the present war period the d sign provides a useful outlet for sho scrap lengths of certain sizes of har drawn copper wire, that might othe wise be junked. Coil portion of t fitting can be either hand or machi wound on a pipe mandrel.

Cost of Adding Auto-Transformer

(From field sheets of Eastern electric utility 1942 Data, Major Transmission Station, Including Labor and Overhead

One 15,000-kva., 3-phase auto-transformer tying 110-kv. and 66-kv. lines together through station buses, outdoor type, 13-kv. tertiary	$28,200
Concrete foundation, 19 cu. yd	971
Galvanized steel structure, 3.7 tons required	900
One galvanized steel turning tower, for 69-kv. section, 1.2 tons	487
One air-break switch, 69 kv	914
Bare copper wire, 450 ft., 7-strand	156
Solid round copper rod, 54 ft. length in toto, ½-in. diameter	62
Three pillar type insulators	142
Suspension insulators, six, with 10-in. clevis	149
One galvanized steel turning table for 110-kv. section, 1.6 tons	541
One air-break switch, 115 kv	1,653
Copper wire, 570 ft. of No. 4/0, 7-strand	129
Solid round copper rod, diameter ½ in., length required, 54 ft	27
Flat bare copper, ¼ x 2 in., total length 12 ft	14
Six additional suspension insulators, 10-in. clevis	125
Three post type insulators	126
Galvanized conduit, 1½ in. diameter, length 500 ft	228
Galvanized conduit, ¾ in. diameter, length 60 ft	54
Six-conductor, 600-volt control cable, 790 ft	321
No. 10 solid conductor wire, 130 ft	37
Two ammeters	90
Two ammeter transfer switches	76
Six relays	228
One cooling tower	700
Cooling water piping and fittings, 118 ft	979
Oil handling piping, 90 ft	97
Railroad siding extension, double gage rails and transfer truck, 40 ft	446
Total over-all cost	$37,947
of per kva., approximately	$ 2

How FRIGIDAIRE'S WARTIME PLAN has helped dealers "keep 'em running"

Back the Attack—
with War Bonds

EARLY in 1942, when it became apparent that existing refrigeration equipment could not be replaced, Frigidaire intensified its efforts to help dealers solve the many problems confronting them.

Because this Wartime Conservation program was based on the wide experience of factory specialists, as well as actual experiences in the field, it has been unusually successful. Covering all phases of service activities from factory to user, it has helped Frigidaire dealers perform an outstanding service job during a very critical period.

Moreover, the Wartime Conservation program is not a one-time affair. It is of continuous help, with up-to-the-minute information and suggestions constantly flowing to the field organization as new problems arise. Here are a few of the reasons why Frigidaire dealers are so enthusiastic about this program:

Factory-Conducted Meetings have been held in all parts of the country to acquaint dealer and district personnel with first-hand details of the Conservation program. Factory specialists are also in touch with the field constantly to lend assistance wherever and whenever they can.

District Meetings and other means have been used to show dealers how to set up an inexpensive service shop; how to conserve time and expense by proper diagnosis of service complaints; how to conserve parts by repairing instead of replacing; how to build customer good will; and how to maintain identity as service headquarters.

Field Training Schools conducted by factory and district instructors have been of great assistance. Hundreds of new and experienced servicemen have received fundamental and advanced training in Household Refrigeration, Commercial Refrigeration, and Electric Range work. Night School classes have been very popular.

A Correspondence Course, over a period of 16 weeks, has had an enrollment of more than 5,000 students. This course embraces Household and Commercial subjects, from basic to advanced information. Personal aid and encouragement are given to each student by district service specialists when grading lessons.

Training Films have been made available to help new servicemen and to "refresh" veterans. Films cover such subjects as "Changing Sealed Rotary Units in Various Style Cabinets," "Service Operations on Household Reciprocating Systems," "The Easy Way to Service and Diagnose the Sealed Rotary System," "Service Operations on Ice Cream Cabinets," and "Servicing Wet Storage Beverage Coolers."

Handy Reference Guides help new servicemen and veterans alike. These easy-to-follow pocket size manuals have proved to be invaluable aids to more intelligent and quicker diagnosis.

Factory Bulletins and the dealer newspaper, the BTU News, are issued regularly to keep the service organization abreast of latest service developments. They also publicize the successful experiences of others and tell the "what, why and how."

Adequate Parts for keeping millions of Frigidaires operating are an important factory responsibility. A large Parts manufacturing department produces, repairs and feeds parts to depots strategically located throughout the country. From there they are distributed to servicing dealers.

Conservation of Critical Materials, affecting the manufacture of hundreds of parts items, has been an important means of assuring the parts and assemblies needed by Frigidaire's servicing dealers.

A continuous major program to help dealers accomplish these 5 important objectives

1. To cooperate with the Government's Food Conservation and Health Protection Program.
2. To help keep the millions of the nation's refrigerators running.
3. To help dealers locate and train necessary service manpower.
4. To help dealers obtain essential service parts.
5. To help dealers build good will and maintain income.

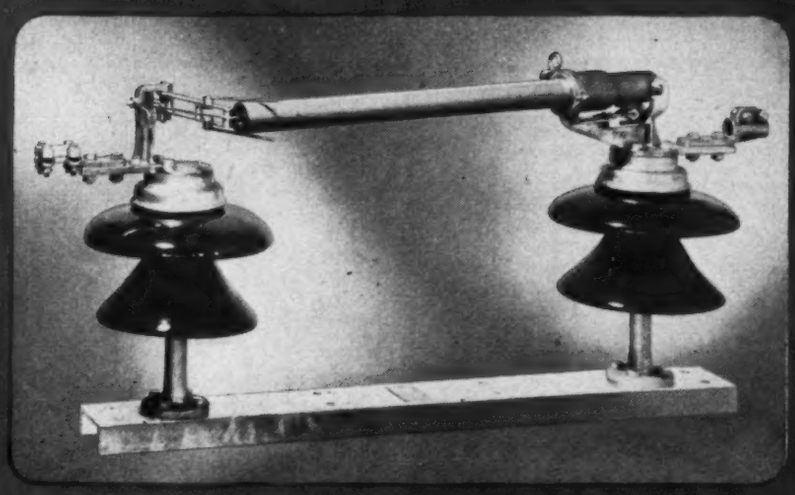
For Excellence in War Production

Every Sunday Afternoon: GENERAL MOTORS SYMPHONY of THE AIR, NBC Network

FRIGIDAIRE Division of GENERAL MOTORS

Peacetime builders of Home Appliances, Commercial Refrigeration, Air Conditioners

Built to Last



HI-VOLTAGE

TYPE T-F-U FUSES

● Here is a unit that will fit into the most modern station design. These fuses may be mounted horizontally or vertically.

The interrupting time is extremely short. When the lower ampere links are used the clearing time is so short that the available short circuit amperes of the circuit may not be reached. On tests with 10000 amperes available the short circuit current was limited to 910 amperes.

By this fast operation the likelihood of damage attending heavy fault currents is reduced almost to the point of elimination.

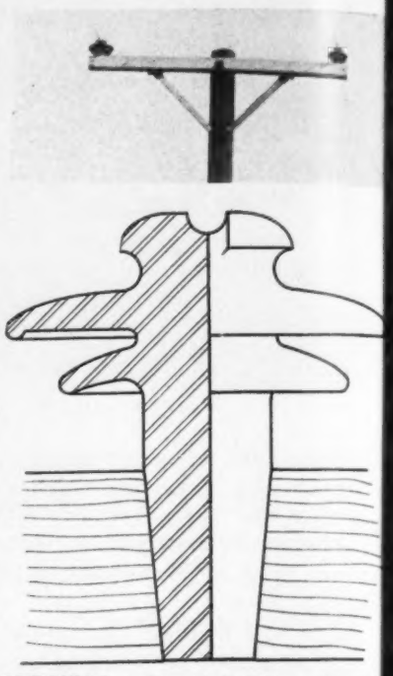
HI-VOLTAGE

EQUIPMENT COMPANY

2891 East 79th Street • Cleveland 4, Ohio

Britisher Develops Pinless Insulator

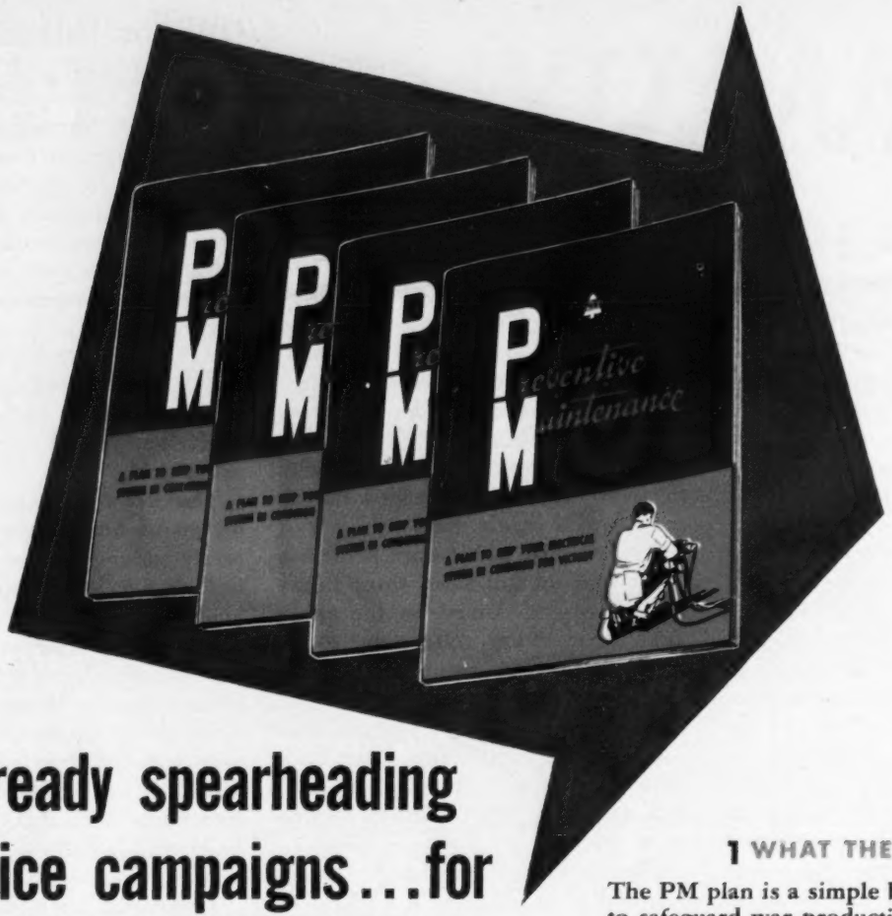
Simulating the unpuncturability o the line-post insulator is a new pi less design for rural-line crossarm developed by G. T. Garwood an manufactured in England by Messr Bullers, Ltd. As described in Britis publications, it is a single-piece porc lain with a tapered shank that fits int



ONE-PIECE pinless insulator fits in tapered socket in crossarm; 11-kv. installa tion shown

a correspondingly tapered hole in th arm. There are no metal parts, th unit being held in position by gravit and the wedging action for the usua situation where no uplift is involved

Dry flashover of the 11-kv. unit i 62 kv., wet flashover 40 kv. and im pulse flashover 300 kv.; all these re sults were obtained with 18 in. of oa crossarm in series with the insulator Advantages claimed in addition t the unpuncturability are cost com parable with the conventional pi type, no metal or cement deteriora tion, rated ultimate transvers strength of 2,000 lb., protectio against malicious damage (becaus the unit lies close above the arm and less time for installation and re placement. The hole in the arm i made by a tool of the bung-bore type. For the 11-kv. unit radio inter ference rating is 40 kv. r.m.s. for dr condition and 20 kv. when under sa spray. A patent application is pend ing in the United States.



Already spearheading service campaigns...for more than 60 Utilities

THE PM PLAN

Introduced a short time ago, Anaconda's Preventive Maintenance Plan is being widely used by utilities to help customers keep electrical systems operating *efficiently*—despite shortages in essential wiring equipment.

Already some 60 utilities are actively engaged in this program. With it, they are helping their industrial power customers maintain continuous wartime production by preventing electrical breakdowns.

1 WHAT THE PLAN IS

The PM plan is a simple but comprehensive way to safeguard war production by preventing electrical breakdowns *before they develop.*

2 HOW IT WORKS

The plan provides a practical means of making periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to *prevent* breakdowns.

3 HOW UTILITIES BENEFIT

The PM plan helps utilities maintain close customer contact despite a lack of "something to sell." Offers basis for service campaign that definitely appeals to customers. Puts the utility in a leadership role for furthering war production throughout the area it serves.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details.

43224

"Tomorrow may be too late . . . do it today!"

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

Anaconda Wire & Cable Company
25 Broadway, New York City 4

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual .....

Company .....

Address ..... City .....

9L

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Farm Appliance Repair Clinic

MORRIS H. LLOYD
Rural Service Supervisor
Niagara, Lockport & Ontario Power Co.

New York State farm people to the number of 17,233 learned the lesson of adequate wiring in 1941 and '42 from the "Wattmobile," a traveling electrical demonstration project of the Cornell University extension service. During 1942, as difficulties in securing materials increased, the demonstration made with the "Wattmobile" became more and more devoted to teaching proper care of appliances and farm equipments. In this year of 1943 the "Wattmobile," minus its trailer, is a traveling repair shop where farmers are given practical instruction on how to make their electrical machines and devices last for the duration.

Use of the "Wattmobile" as a maintenance and repair clinic is a return to its beginnings, for it resulted from work done by Prof. H. S. Pringle with home bureau groups on care and repair of household appliances. Professor Pringle had been conducting meetings with these groups at which the women brought in small appliances that needed repairs. When the repairs required could be made by the owner, such as replacing appliance plugs or damaged cords, they performed the work under Professor Pringle's guidance. He also endeavored to diagnose the trouble with those appliances that needed the attention of a repair man.

In the course of his work Professor Pringle found that many times faulty operation was blamed on the appliance, whereas low voltage due to inadequate wiring was actually the cause of the trouble. Out of this experience came the "Wattmobile," jointly financed by the New York State College of Agriculture at Cornell and by electric utilities serving rural areas of the state.

During the past winter the extension service conducted a number of motor repair clinics in rural communities. These were in the charge of an engineer from the extension service, and farmers brought in motors, cleaned them, and made minor repairs under this engineer's guidance, and with the assistance of rural service representatives of utilities. These clinics were well attended and the interest shown was quite pronounced. Plans have been made to use the "Wattmobile" truck without trailer, equipped as a traveling motor repair shop, to take "clinics" to small groups of farmers who cannot take the time or spare the gasoline to come in to larger meetings.

Utilities Introduce Farm Grain Elevator

During the harvest season this year many Michigan farmers will be using a victory model, home-made, portable grain elevator which is being recommended to farm customers by several private utilities operating in the state. Sponsoring companies include Consumers Power Company, Detroit Edison Company, Michigan Public Service Company, Indiana & Michigan Power Company and the Menominee & Marionette Light & Traction Company.

The elevator, which can be built for about $6, less motor, has a capacity ranging between 100 and 300 bushels per hour, depending on the kind of grain, the length of trough and the angle of elevation. In operation the elevator drags grain up an inclined wooden trough using wooden cleats on a rope conveyor that passes over a V-pulley in each end of the trough. It was developed as a wartime emergency tool that farmers could build readily from materials available in any community.

Details of the design, which is shown in the accompanying illustrations, are as follows:

Trough—Bottom board 4 in.; side boards 8 in.

Conveyor Rope—Size ½ in. Use long splice.

Cleats—Size 3½x1½x1⅛ in. Suggest ponderosa pine. Staple cleats 3½ in. apart on conveyor rope. Use 1½ in. staples.

Pulleys—Use 3-in. V-pulley in each end of trough for conveyor rope. Drive pulley, 8-in. V. May be made of two pieces of plywood with edges beveled.

Drive Shafts—Use ½x10 in. carriage bolt. Cut extra thread for jam nuts, washers, if wood drive pulley is used. Lower shaft, ½x8-in. carriage bolt. File flat spots on bolts for V-pulley set screws.

Bearings—Conduit ½ in. set in wood blocks. Provide oil holes.

Guide Rails—Make ⅞x3 in. along each

"WATTMOBILE," after two years of promoting adequate wiring to rural customers, is shorn of its trailer and used as portable clinic to teach proper maintenance and repairs of appliances and equipments on New York farms

PHILCO VITRABLOC

. . . THE GREATEST CONTROL BATTERY NEWS IN YEARS!

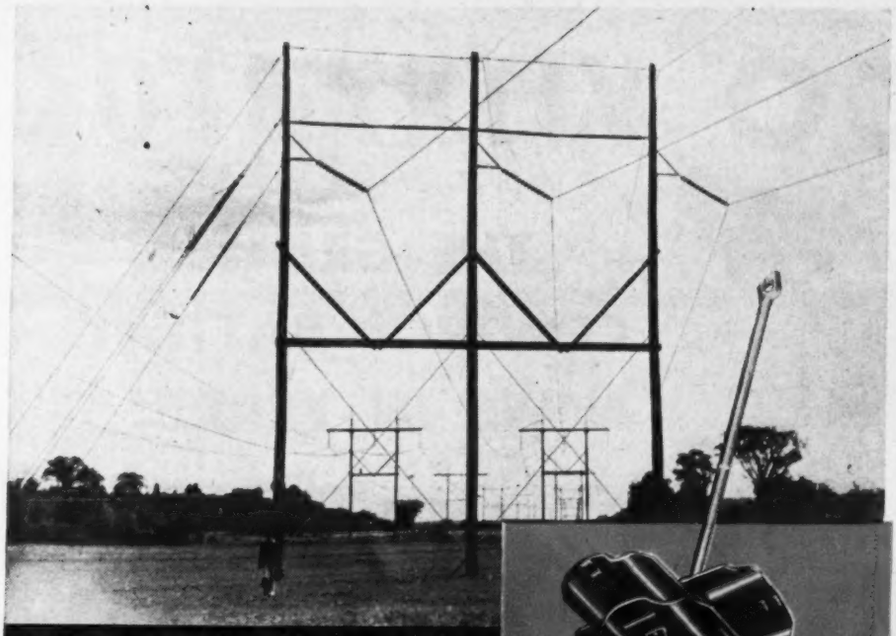
EXCLUSIVE PHILCO FLOTÉ CONSTRUCTION

Among utility engineers, few battery developments have created such wide-spread interest and enthusiasm as Philco Vitrabloc. And it's understandable . . . this vitrified ceramic cell materially increases capacity of existing battery rooms! Explosion-proof and spray-proof, Philco Vitrabloc incorporates the famous Philco Floté element—the only construction specifically designed for modern, full float service! Philco Vitrabloc cells are now available on exceptionally low priority. Write for catalog giving complete engineering specifications.

PHILCO CORPORATION
STORAGE BATTERY DIVISION • TRENTON, NEW JERSEY

REPLACE WITH PHILCO BATTERIES

ARMY E NAVY



Where pole lines take the place of towers . . .
CHANCE ANCHORS will carry the load

Pole Lines that go up to save steel for war are proving to be adequate for carrying the heavy loads and a good deal of the credit must go to the big Never-Creeps, the Chance Steel Expanding, and other Chance Anchors that keep the lines well guyed.

The variety of anchors shown here meet the most complicated requirements. One of the Never-Creeps, for instance, is made in a 10 x 45 inch size and is rated to hold over 50,000 pounds in hard pan. A big 12-inch four-way steel expanding anchor is rated at 42,000 pounds in the same soil and can be installed in a variety of positions.

Chance Screw Anchors are shown here in three types and are made in several sizes for different conditions.

The Swamp Screw Anchor does the job in swamp land and may be installed under water in flooded areas.

Where rocks abound, the Chance Rock Anchor holds without the aid of lead or concrete and saves a lot of installation time.

Chance Cone Anchors range into big sizes too. There's a 23-inch regular, rated to hold 32,000 pounds. Another special cone measures 32 inches in diameter.

Standardization, of course, is best wherever it is possible to use one type and size anchor throughout, but the best results cannot always be obtained in that manner. That is why Chance Anchors are made in so many different types and sizes. It pays to analyze each job and select anchors accordingly.

This free guy calculator will help you in making anchor selections. Your Chance catalog will give you the details for ordering. Send for either one or both without obligation.

A·B·CHANCE CO·
CENTRALIA, MISSOURI.
ABC INDUSTRIES

side of trough between upper and lowe cleats, bevel ends so cleats won't strike.

Feed—Drill five 3-in. holes on each si to feed grain from hopper to trough.

Rope Tension—Mount upper shaft side of cap. Slide cap on elevator so upp shaft slides in ½x18-in. kerf cut in sid of trough. Attach harness breast chain top of cap. Fasten wire to chain, pa through kerf cut in top of cap and attac to end of trough. Adjust breast chain fo proper tension.

Motor—Type, capacitor or repulsion-in duction. Size ¼ hp. up to 18 ft. lengths o elevator. Use ⅓ to ¼ hp. for lengths ex ceeding 18 ft. Use 3 3½-in. V-pulleys o motor; ⅜ in. rope belt. Long splice ma be used from motor pulley to drive pulle if rubber V-belt is not obtainable. Do no use a split phase motor—starting torque i too low.

Specifications and plans for build

Home-Made grain elevator for farm us will elevate 100-300 bushels per hour depending on type of grain, length o elevator and angle of elevation

ing the elevator have been distributed in blueprint form through high schools, agricultural schools, 4-H club groups and similar organiza tions. A number of 4-H club groups are building these elevators as one of their handicraft projects.

Working models have been dem onstrated to lumber dealers in the various company territories, who have assisted in distributing drawings to interested customers. In one utility territory a farm supply store has con tracted with a local lumber company for 50 such elevators to be sold as merchandise. The design has been further publicized in Michigan farm publications in advertisements spon sored by the several utility companies which were listed in an earlier para graph.

Consumers Power Company, which introduced this elevator on several farms in its service area last year,

M-R *Extruded* PLASTIC TUBINGS

MITCHELL-RAND *for* **54 YEARS THE ELECTRICAL INSULATION HEADQUARTERS**

MIRAFLEX
MIRATEN
MIRALON
MIRAGLAS
MIRADIE

	MIRAFLEX	MIRATEN	MIRALON	MIRAGLAS MIRADIE
Dielectric Strength 020 Wall Dry Wet	750 VPM 350	1000 VPM 1000	1000 VPM 1000	850 VPM 815
Water Absorption after 34 hours	1.5%	0.5%	0.6%	0.4%
Tensile Strength lbs. per sq. in.	2,150	4,000	4,000	3,000
Life at 105° C.	400 hrs.	1,000 hrs.	1,000 hrs. (plus)	
Resistance to Brittleness	Does not become brittle or shatter at —40° F. —58° F. —50° C.			
Wemco Oil Test 48 hours.—100° C.	All grades passed satisfactorily			

non-combustible
extremely high dielectric
great tensile strength
solders successfully
ages very well
flexible and elastic
resists solvents
resists high and low temperatures
resists abrasion
won't brittle
thin or thick walls
moisture proof
made in transparent and six colors

FREE FOR YOUR ASKING. A Sample Card of Varnished Tubings, samples to fit sizes from B&S wire 220 (.032") to 20 (.325") . . a Wall Chart with quick easy to read reference tables of electrical symbols, capacity of conductors, dielectric averages of insulating materials, mathematical tables, tap drill sizes, standards of varnished tubing sizes . . . Wax and Compound Guide Book and the M-R Book of Electrical Insulations.

ALL ARE FREE FOR YOUR ASKING . . . WRITE FOR THEM ON YOUR LETTERHEAD

INSULATION M-R COMPANY EST. 1889

MITCHELL-RAND INSULATION COMPANY, INC.

51 MURRAY STREET **COrtlandt 7-9264** **NEW YORK 7, N. Y.**

Fiberglas Varnished Tape and Cloth
Insulating Papers and Twines
Cable Filling and Pothead Compounds
Friction Tape and Splice
Transformer Compounds

A PARTIAL LIST OF M-R PRODUCTS

Fiberglas Braided Sleeving
Cotton Tapes, Webbings and Sleevings
Impregnated Varnish Tubing
Insulating Varnishes of all types

Fiberglas Saturated Sleeving and Varnished Tubing
Asbestos Sleeving and Tape
Extruded Plastic Tubing
Varnished Cambric Cloth and Tape
Mica Plate, Tape, Paper, Cloth and Tubing

From an arsenal of fire fighters including such famous names as Fire Guard, Alaskan, and Floafome, General Detroit gives you C-D/Fog.

Newest of carbon dioxide extinguishers, C-D/Fog snuffs out fire by enclosing it in an icy grip. Air cannot reach the flame.

C-D/Fog leaves no stain. It is safe to use on electrical, oil, and gasoline fires. It is equally efficient in hot or sub-zero weathers.

General Detroit's known record in quality mass production assures you prompt delivery for all essential needs.

"Fire Protection is Victory Effort"

THE GENERAL DETROIT CORP.

Former Name The General Fire Truck Corp.

New York • DETROIT • Chicago

West Coast Affiliate: THE GENERAL PACIFIC CORP., SEATTLE • LOS ANGELES • SAN FRANCISCO

Distributors in All Principal Cities

THE GENERAL DETROIT CORP. GENERAL DETROIT
2218 East Jefferson Ave.,
Detroit, Mich.

Please rush details on C-D/Fog and others in your complete line of fire extinguishers.

*Name*_____

*Title*_____

Tear out this simplified coupon and attach to your letterhead.

estimates that 500 will be used on company lines in 1943.

•

Welcome, Newcomers!

Every newcomer in the territory of the Washington Water Power Company is the recipient of a friendly, personalized welcome to the Inland Empire, which has been served by that company for 54 years. Some conception of the size of this "greeter" job is indicated by the fact that 7,000 new consumers have been added to the lines since last fall in the Spokane area alone, representing an increase of some 35,000 in population. Applications are still coming in at the rate of about 20 a day.

Practically all new residents come early to make application for electric service. At that time a separate card is made out at the service desk, giving name and address, only, for use in the "Welcome, Newcomer" campaign. Soon thereafter a booklet is delivered personally by the neighborhood representative, the service man or the local manager of the district. The same is done in the case of the new industrial and commercial consumers.

The booklet, 16 pages and cover, is entitled: "Now That You Live Here." After a brief message from President Kinsey M. Robinson, the booklet leads off with interesting facts about the Inland Empire, its history, geography, resources and products. Then come the sources of electrical energy and its utilization as exemplified by the operation of the Washington Water Power Company; helpful hints on electrical service; a page on short scenic circle trips easily made from Spokane, and a map of the distribution system.

Personal delivery of the booklet and the welcome is made upon rendering the first month's bill, which is delivered along with the booklet. The bill is explained and also the rates. The representative then goes through the book page by page, pointing out the interesting features and at the same time bearing down on the matter of what the consumer can do to help the company to maintain wartime service, as regards blackouts, care of appliances, and where certain appliances are still available.

Coincidentally, a series of advertisements is being run in all local newspapers on the subject of welcome to newcomers, the advertisements being of the testimonial type.

As a final link in the welcome campaign, all employees are encouraged to call on newcomers in their neighborhoods and extend their personal welcome in behalf of the company. This was started April 1 of this year and is meeting with good response on the part of the employees.

To Help the Dairy Farmer

Check-Up Chart on

Dairy Electric Equipment

SAFETY FIRST Always pull the switch before working on equipment. And be sure to close switch when through with work.

*Date column and check opposite each item as it is handled.

EQUIPMENT	DATES OF CHECK-UP			
Compressors				
WIPE DIRT and grease off compressor—especially off the condenser. Blow any objects that somehow work free circulation of air around compressor.				
OIL motor bearings. Use No. 10 S.A.E. oil.				
EXAMINE BELTS. They should be snug but not tight or loose. If badly worn or frayed, secure spare for emergency use.				
(NOTE: If compressor short-cycles [starts and stops every few minutes] it should be adjusted by competent servicemen.)				
Walk-in Rooms and Cabinets				
TEST DOOR-GASKETS by inserting sheet of paper between door and jamb, then closing door. If paper slips out too easily, your air-seal is not good, and gasket should be replaced.				
OIL HINGES and door-latches. This will prevent rust and breakage.				
Brine Tanks				
IF BRINE IS LOW, additional brine may be obtained by dissolving calcium chloride in water. Calcium chloride may be bought in moisture-proof containers in 100-pound bags. Dissolve in WOODEN pail or barrel. LET STAND FOR 24 HOURS before pouring in tank. Usual mixture — 5 pounds of calcium chloride to each gallon of water. You can test specific gravity of brine in tank by dropping in an inch potato. If it floats, brine is sufficiently dense for normal dairy operations.				
(NOTE: Some of the older installations used salt instead of calcium chloride. They should not be mixed.)				
EXAMINE BRINE-PUMP packing, brine lines and strainer for leaks.				
OIL brine-pump motor.				
EXAMINE ICE CANS for leaks. If any, they should be welded.				
Water Pump				
IF PISTON (or reciprocating) type, change oil to crank-case. Use No. 10 S.A.E.				
OIL motor bearings. No. 10 S.A.E. o. k.				
EXAMINE belt — same as for compressor belts.				
EXAMINE PUMP PACKING. Also repair any dripping faucets. Any leak causes unnecessary running.				
Fuses				
FUSES are for your protection. It is UNSAFE to use pennies or any other metal behind blown fuses. Keep on hand at least one of each of the sizes you use.				
Repairs You Cannot Handle				
Call the G. in Power Company for experienced assistance.				

This reminder and check-up chart, 15 in. high, 12 in. wide, has been mailed by the Georgia Power Company to all customers who have dairy electric equipment. Letter accompanying the chart suggests that it be tacked up in the milk house, that its directions be carefully followed and that a call to the company will bring experienced assistance.

AIR is LIFE
to a stratosphere pilot...
BUT DEATH
TO UNSTABLE
TURBINE OILS!
NO MATTER what kind of turbine you operate, air bubbles are going to get into the oil. As a result, a constant battle is waged between oil and air. And once oxidation gets the upper hand over an unstable oil it breaks down rapidly.
However, this is not true of Shell Turbo Oil. For this history-making oil has the ability to resist oxidation to a degree never before thought possible in turbine oil operation.
But in today's high speed turbines even *oxidation stability* is not enough. A turbine oil must also be able to *prevent rust.* Shell Turbo Oil has both of these requirements necessary to economical, trouble-free turbine operation. And it's because of these superior qualities that more and more operators are draining, flushing and refilling their turbines with Shell Turbo Oil.
For full details call in the Shell man. Or, write Shell Oil Company, Inc., Dept. "F," 50 W. 50th Street, New York 20, N. Y. or 100 Bush Street, San Francisco 6, Calif.
SHELL
SHELL TURBO OIL
Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil

NEW EQUIPMENT

Connectors

In a new line of connectors the conductors are gripped by means of U-bolts with integral saddles. Stocked items are

"Multifit" connectors; straight connectors and reducers, tees and terminal lugs, each made for a range of cable sizes up to 2,000,000 cir.mil. **Penn-Union Electric Corp.**, Erie, Pa.

straight connectors and reducers with two, four or more bolts; tees with one or two bolts on run and tap; terminals with any number of bolts, straight or angle flanges, variously drilled.

•

Water Conditioner

"K.A.T." water conditioner; available in one-gallon glass bottles. **American K.A.T. Corp.**, 331 Madison Ave., New York, 17, N. Y.

A collodial solution has been developed as an anti-scale anti-foaming and anti-corrosion agent for treating water in laboratory and industrial stills. It is said to form a protective coating on the interior of the still and at the same time sheathes the impurities in the water to form a sludge easily removed by flushing. A minimum of 2 oz. per day for 1- or 2-gal. stills, 4 oz. for larger stills, is required for water of average hardness, it is claimed.

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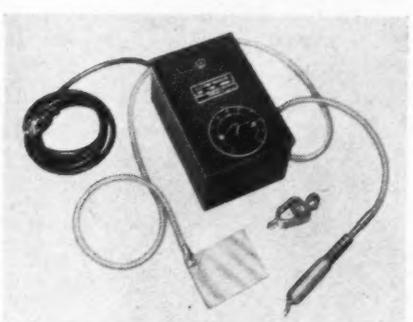
Marker

An electrical marker, an addition to the company's line, has been designed primarily for freehand marking on soft or



"Electro-Marker" marking unit; available for 115 or 230 volts, 25, 50 or 60 cycles. **H. P. Preis Engraving Machine Co.**, 157 Summit St., Newark, N. J.

hardened steel, ferrous alloys, wrought and cast iron. Equipment consists of a transformer with ten voltage stages controlled by a rotary switch, a hand-held marking pencil with a point that stands vertical to the work when holder is placed in a normal writing position, a ground plate and a ground clamp for attachment to the work.

•

Rheostat

Circular rheostat-potentiometer; resistance, maximum 1 ohm, minimum total 0.1 ohm. **Ohmite Manufacturing Co.**, 4835 West Flournay St., Chicago, 44, Ill.

Slide-wire rheostat has a length of resistance wire stretched around the outside of a cylindrical core which is bonded to a ceramic base. Provision of three terminals allows unit to be used as a potentiometer or voltage divider. Since the rotatable contact arm travels along the wire, the resisttance variation is stepless. These units have been designed for low-resistance, low-wattage applications and are made to order.

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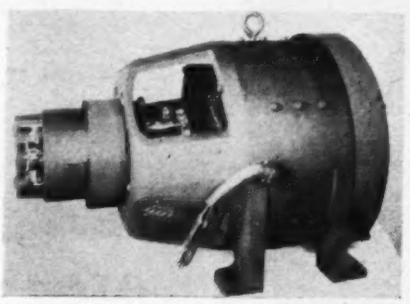
A.C. Generator

An addition to the company's line is a revolving armature type generator for direct



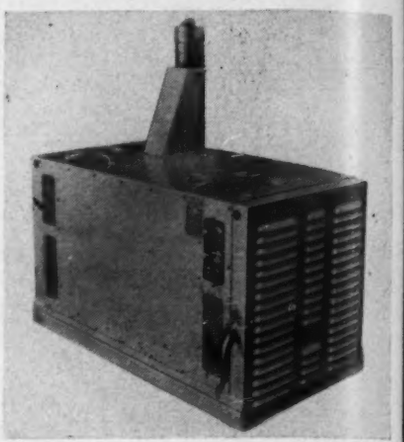
"Model 55" a.c. generator; rated 25 kw., 80 percent power factor, single phase, or 30 kw., 80 percent power factor, three phase, standard and special voltages. **Kato Engineering Co.**, Mankato, Minn.

attachment to engine bell housing or as an independent generator with standard shaft extension. Armature of two-pole, interpole, 125-volt exciter coupled to alternator shaft. Unit can be furnished for either direction of rotation.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Truck Power Units

Self-contained power units consist of a gasoline engine coupled to a d.c. generator with accessories mounted in a steel housing for fastening to a truck chassis. Electric power is delivered to the truck motors through standard electric truck control mechanism. Automatic idling is obtained by syncotrol governor to save fuel and en-



Model "J" gas-electric power units; available for 10- to 30-ton electrical industrial trucks. **The Ready-Power Co.**, Detroit, Mich.

gine wear. The unit is claimed to be a smaller over-all model with greater power capacity and supersedes model "G."

•

Spot Gluer

"Radio Nail Gun" or spot gluer; output approximately 50 watts and operating frequency about 200 megacycles; equipped with an electronic timer which can be set to control the interval of application. **Radio Corporation of America**, Camden, N. J.

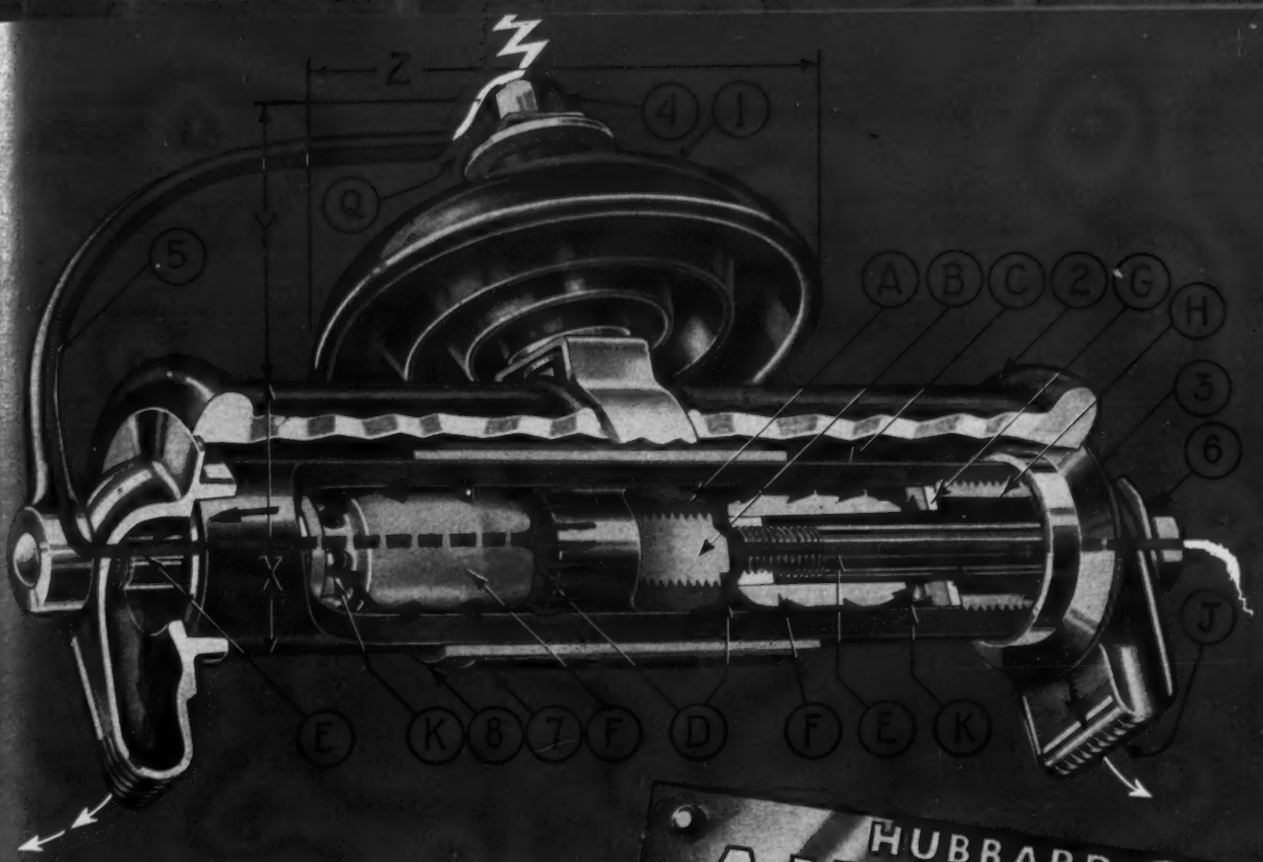
An almost instantaneous method of "tacking" or spot joining of thin sections of plywood, plastics or other industrial materials with "radio nails" can be made by a spot gluer resembling a short-barreled automatic pistol or a narrow-based electric flat iron. The "gun," or applicator, is connected by cable to a portable radio-frequency generator. In this spot-gluer, a pin extending lengthwise down the center of the barrel forms one electrode, while the barrel casing is the other. In operation the muzzle is pressed against the material over the spot to be bonded and the current is applied by pressing the trigger. Since the material to be bonded is a better conductor than the air between the pin and barrel casing, the current, following line of least resistance, between electrodes, follows a curved line through the material.

•

Battery Chargers

Battery chargers; low-voltage types 6-12 volts, communications types 24-48 volts, general utility types 110 volts and up. **Selenium Rectifier Division, Federal Telephone & Radio Corp.**, East Newark, N. J.

A new line of battery chargers includes a selenium rectifier as the heart of the equipment. Inherent characteristics of the a.c.-to-d.c. unit are said to provide automatic reduction of the charging current as the battery voltage increases, giving a tapered charge that protects batteries from excess temperature or undue gassing without the use of manual or automatic switching equipment.



1. Wet Process Porc. Ins.
2. Wet Process Porc. Tube
3. Exhaust Shield
4. Line Terminal
5. Arc Horn
6. Ground Terminal
7. Steel Sleeve
8. Fibre Sleeve
A. Composite Fibre Barrier
B. Threaded Core
C. Fibre Tube
D. Electrodes
E. Stud
F. Fibre Exhaust Sleeve
G. Washer
H. Threaded Sleeve
J. Exhaust Vents
K. Exhaust Ports
Q. External Gap

HUBBARD AUTOGAP LIGHTNING ARRESTERS

The path of a lightning discharge through a Hubbard Autogap Arrester is shown by the heavy red line, solid and broken. Arrows show the course of exhaust gases after the arc is blown apart. Although, for sake of clarity, the illustration shows numerous "streamers" encircling the barrier "B", this is not necessarily true to fact, since the path MAY be single for each operation but through many operations, will seek a multitude of DIFFERENT paths.

1 The Autogap Barrier "B" offers a cylindrical gap of fibre between electrodes "D". In operation, the path of lightning discharge is over any part of the surface of this cylindrical barrier. THERE IS NO "BEATEN PATH"!

2 Due to the gap "Q" the barrier "B" is not in a leakage path to ground, therefore not subject to CONTINUAL burning by leakage currents. This feature also provides Hubbard Autogaps with a long life of service. AUTOGAPS OPERATE ONLY WHEN NEEDED.

3 The "explosion" resulting from operation under excessive voltage is exhausted in two opposite directions from the barrier with ample freedom of passage to the open air. One more point providing longevity of service without interruption or MAINTENANCE.

4 Installation may be made on crossarm, pole or transformer and all three types may be easily covered with rubber blankets. Unexposed line connection styles may be obtained if desired.

5 Made in several styles, various capacities and with mountings for any circuit, all styles operating on the same principle.

Make a note of these features—

HUBBARD

HUBBARD AND COMPANY

2¢ WOULD HAVE PREVENTED THIS SHUT DOWN

. . . 2c MORE FOR A NON-RUSTING BOLT IN A VITAL PART

CAN A COUPLE OF PENNIES more per bolt save thousands of dollars? Indeed they can . . . and Harper Fastenings are proving it every day. Saving huge sums by preventing hidden destruction by rust and corrosion. They help war production machinery to stand up under today's grueling speed and overtime.

Such tremendous trifles, these Harper non-ferrous and stainless fastenings. Trifling too, in their extra cost. Yet tremendous in their usefulness.

4320 STOCK ITEMS . . . of bolts, nuts, screws, washers, rivets and accessories in the non-ferrous and stainless alloys.

WRITE FOR CATALOG . . . and reference book —80 pages—4 colors—193 illustrations—numerous tables and other data. Free when requested on a company letterhead.

THE H. M. HARPER COMPANY
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EVERLASTING FASTENINGS

BRASS • BRONZE • COPPER • EVERDUR
MONEL • STAINLESS

TECHNICAL LITERATURE

A.I.E.E. STANDARDS — The following standards have been published by the American Institute of Electrical Engineers, 33 West 39th Street, New York: Alternating-current Power Circuit Breakers (Supersedes No. 19-1938, approved June 19, 1941, No. 19, price 40 cents). Electrical Installations on Shipboard (45A, 4/1/43, Modification of and supplement to No. 45 the 1940 edition with addenda of 2/16/42; to apply during national emergency only).

A.S.A. STANDARDS—The American Standards Association has released the following new American standards. Five are sponsored by A.I.E.E.: Graphical Symbols for Power, Control and Measurement (2/6/43, Z32.3-1943, price 40 cents). Graphical Symbols for Telephone, Telegraph and Radio Use (11/4/42, Z32.5-1943, price 40 cents). Graphical Symbols for Architectural Plans (2/6/43, Z32.9-1943, price 40 cents). The following were sponsored by the Electrical Standards Committee: Rotating Electrical Machinery (3/29/43, C50-1943, price $1.25). Specifications for Cotton Braid for Insulated Wire and Cable for General Purposes (Revision 2/6/42 of C8K2-1932, C8.12-1942, price 25 cents). Specifications for Rubber-Insulated Tree Wire (5/14/40, C8.16-1940, price 25 cents). Specifications for Weather-resistant (Weatherproof) Wire and Cable (URC Type) (11/6/42, C8.18-1942, price 25 cents).

LINES AND SUBSTATIONS—Hughes Brothers, Seward, Neb., have issued a new catalogue (No. 10) of 226 pages which has a 90-page engineering section showing how to compute the stresses when applying wood poles and members in transmission line, terminal, angle, transposition and substation structures for voltages up to 220-kv.

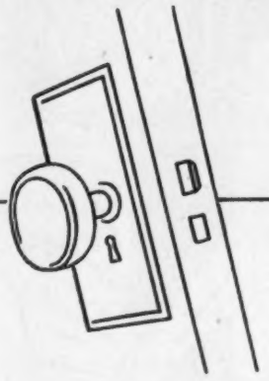
RADIO PRIMER—A 68-page primer is intended to help the beginner understand the fundamentals of radio and is the outgrowth of a training course in radio prepared for people employed in nontechnical positions. The book, "ABC's of Radio," may be obtained from the Advertising Division, Electronics Department, General Electric Co., Bridgeport, Conn., for 25 cents in coin.

RESISTANCE UNITS—Typical characteristics of negative temperature coefficient electrical resistance units are presented and illustrated by practical applications and graphs in a 14-page bulletin issued by Keystone Carbon Co., Inc., Saint Marys, Pa.

DRYING LAMPS—"Radiant Heat Drying Lamps" is a 12-page illustrated booklet discussing radiant heat, design of radiant heat installations, and provides specific data for evaporation of water or other solvents, paint drying, and increasing temperatures of materials to facilitate manufacturing processes. In addition formulas are given to determine wattage required for each application. Copy of booklet A-3817 may be secured from the Westinghouse Lamp Division, Bloomfield, N. J.

"OPERATIONS OF HOT PROCESS SOFTENER at 50 lb. Gage Improves Performance and Saves Chemicals" is title of publication No. 25 issued by Cochrane Corporation, 17th and Allegheny Ave., Philadelphia, Pa. This pamphlet illustrates the effectiveness of high temperatures in reducing hardness with lime and soda treatment of raw water.

We've An Open Door For Open Minds



Manufacturers...Designers...Technicians... Sales Executives and others now giving thought to economical production of Tomorrow's new and better products, are invited to investigate the unique facilities of the Magna Manufacturing Company for the practical disintegration of materials heretofore unavailable in powder form.

TRACER BULLETS, parachute flares, illuminating signals require powdered magnesium...and plenty of it! To reduce this difficult and extremely hazardous metal to a uniform dust in compliance with rigid U. S. Army and Navy standards, Magna developed special machinery and precision processes.

Today in three great Magna Plants... the largest and most modern facilities of their kind ...we are carrying on this vital wartime job. But Tomorrow...

The facilities that Magna perfected have a far-reaching importance... opening vast new possibilities for the utilization not only of magnesium but also all other types of disintegration-resisting metals and other materials such as ceramics, plastics and pigments.

AN INVITATION...

Magna capacities today are entirely occupied with production for Victory. However, Magna engineers are prepared to consult with forward-looking industries on ways and means to utilize powdered metals and other materials in postwar product developments.

MAGNA MANUFACTURING COMPANY, INC.

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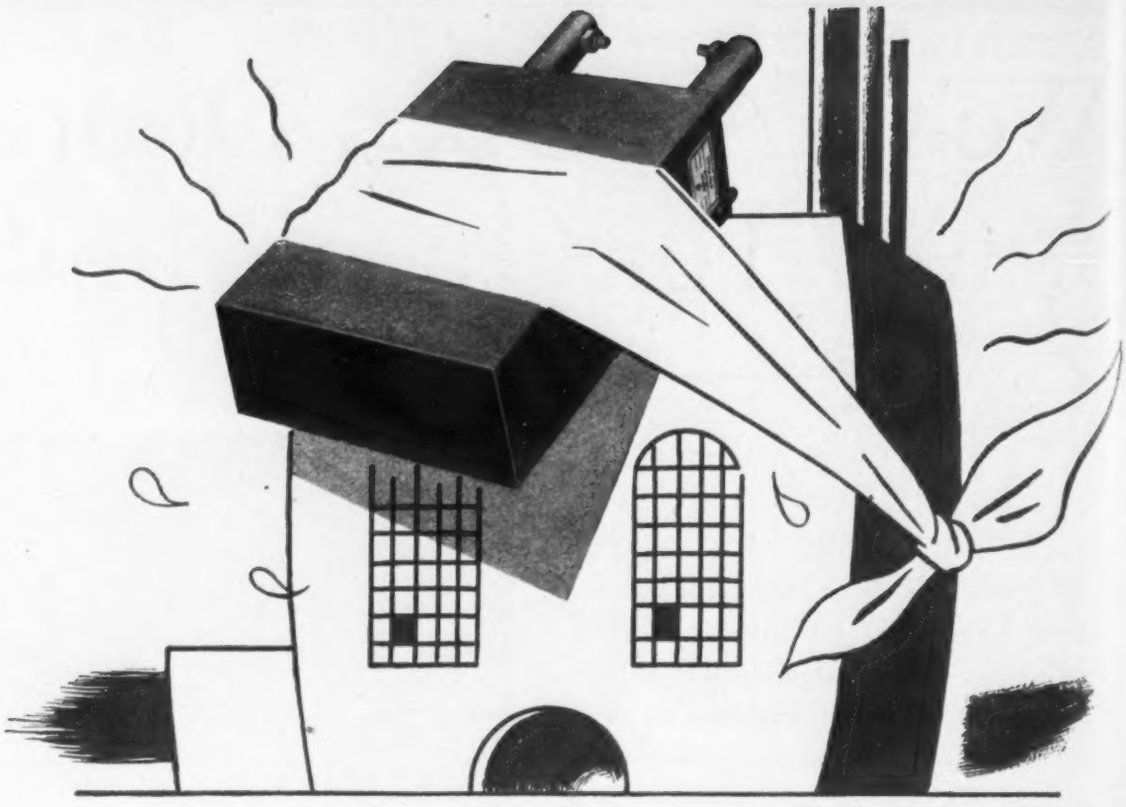

QUICK RELIEF for overloaded systems... with Westinghouse INERTEEN CAPACITORS

Relief for overloaded systems doesn't necessarily call for more lines and equipment. Where part of the overloaded condition is due to low power factor caused by inductive loads, the cure is quick and simple—Westinghouse Inerteen Capacitors.

By improving power factor, Inerteen Capacitors relieve lines and equipment of "dead-head" current, and quickly release capacity for useful power. All-around system performance is measurably improved. Installation is simply a matter of installing capacitors at the substation or on the distribution circuits.

To relieve feeder problems, and wherever industrial customers have a heavy inductive load that is taxing present lines and equipment, recommend Westinghouse Inerteen Capacitors. For more information, call your nearest Westinghouse Office or write Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

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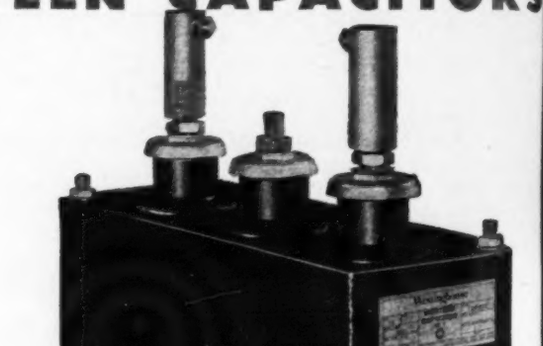

ONE-THIRD TO ⅔ KV-A OF LOAD-CARRYING CAPACITY IS RELEASED BY EACH CAPACITOR KV-A INSTALLED

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FOR EXAMPLE: One utility provided 6,000 additional kv-a of power for a new tank plant by installing 15,000 kv-a of capacitors.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

INERTEEN CAPACITORS

NEWS ABOUT PEOPLE

Executive Appointments Announced by P. G. & E.

At a recent meeting of the board of directors of the Pacific Gas & Electric Co., Paul M. Downing was appointed executive vice-president of the company and A. E. Wishon was made vice-president and general manager. Both men are directors of the company.

Mr. Downing has served the company 42 years, during the past fourteen of which he has been vice-president and

Paul M. Downing

general manager. In addition to specific assignments, Mr. Downing will assist the president in the general supervision of the company's affairs.

Mr. Wishon has been 34 years in the service of the company and its subsidiaries. He was formerly president of the San Joaquin Light & Power Corp., now a part of the Pacific System, and for the past thirteen years has been vice-president and assistant general manager of Pacific Gas & Electric.

•

▶ JOHN M. HOLLINGSWORTH has been appointed manager of the newly organized sales promotion department of the Iowa-Illinois Gas & Electric Co. whose headquarters are in Rock Island, Ill. A member of the United Light & Power Service Co. organization in the capacity of advertising manager since 1929, Mr. Hollingsworth will have charge of all sales promotion and advertising activities of the Iowa-Illinois Gas & Electric Co. group. His office will remain in Davenport, Iowa.

▶ H. F. LEHMAN has been appointed assistant general sales manager in charge of appliance and commercial sales and service departments, Frigidaire division, General Motors Corp. L. A. CLARK has been named assistant general manager responsible for all advertising, sales promotion, training and other related activities. Mr. Lehman was formerly manager of the Frigidaire commercial and air conditioning sales division and Mr. Clark's former position was advertising and sales planning manager.

▶ W. W. PITTMAN of Dania, Fla., has been appointed local manager of the Georgia Power Co. at Arlington, to succeed G. H. FLYNT, resigned.

•

Consumers Power Makes New Assignments

Consumers Power Co., Jackson, Mich., has announced several transfers following the resignation from the company of Lloyd A. Southard, electric distribution superintendent of the Muskegon division. George A. Newson has been named to succeed Mr. Southard in the Muskegon division. He had held the same position in the Manistee division for three and a half years. Mr. Newson joined the company in Kalamazoo in 1926, following graduation from the University of Michigan, and worked successively in Jackson, Alma and Muskegon before going to Manistee in 1940.

To succeed Mr. Newson as electric distribution superintendent of the Manistee division, W. Gordon Hagadorn has been transferred from the Cadillac division, where he held the same position. Mr. Hagadorn joined Consumers in 1927 and worked in Jackson and Saginaw before going to Cadillac for the company in 1930.

The new electric distribution superintendent of the Cadillac division is Raymond P. Paynter, transferred from the Alma division, where he was division engineer. A graduate of the University of Michigan, Mr. Paynter joined Consumers in Battle Creek in 1925. Successor to Mr. Paynter as division engineer of the Alma division is Henry F. Niedzielski, formerly supervising engineer of the same division.

•

G. W. Spaulding Elected Utility Vice-President

Pennsylvania Water & Power Co. has announced the election of G. W. Spaulding, formerly superintendent of power, as a vice-president of the company.

Mr. Spaulding has been with the company since 1924, having been its test engineer, assistant chief of tests, assistant to general superintendent in

charge of power studies and system planning, assistant chief engineer, coordinating engineering studies and construction activities, and superintendent of power.

He is a graduate of the Massachusetts Institute of Technology.

•

OSCAR M. FRYKMAN, formerly chief electrical inspector of Minneapolis, is now associated with the Porter Electric Co. of Minneapolis as sales engineer. Mr. Frykman was identified with the electrical inspection department of the City of Minneapolis for 33 years. Prior to that association he was connected with the telephone industry and with the electrical contracting business. Some years ago he was president of the Western Association of Electrical Inspectors.

▶ WALTER B. WESSELLS has been appointed research engineer in the California Railroad Commission's public utilities department. Mr. Wessells succeeds LOREN W. EAST, who resigned to engage in private practice as a consult-

CASH PRIZE CONTEST!

FOR RADIO MEN IN THE SERVICE!

"Write a Letter"

As you know, the Hallicrafters make SCR-299 Communications trucks. We are proud of our handiwork and proud of the job you men have been doing with them on every battle front.

RULES FOR THE CONTEST

We want letters telling of actual experiences with SCR-299 units. We will give $100.00 for the best such letter received during each of the five months of November, December, January, February and March! *

We will send $1.00 for every serious letter received so even if you should not win a big prize your time will not be in vain.

Your letter will be our property, of course, and we have the right to reproduce it in a Hallicrafters advertisement.

Good luck and write as many letters as you wish. V-Mail letters will do.

W. J. Halligan

*Closing dates: midnight of last day of each month!

BUY MORE BONDS!

the hallicrafters co.

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MAKERS OF THE FAMOUS SCR-299 COMMUNICATIONS TRUCK

ing engineer in Los Angeles. Mr. W sells is a graduate in engineering Johns Hopkins University. He has be employed by the Commission for t past 16 years and has participated numerous telephone rate proceedin He took part in the development of tion-wide procedures in telephone r regulation at Washington, D. C., Ne York and Chicago. In his new positio Mr. Wessells will be responsible for ge eral investigations of utility operatio and earnings, and special investigatio as directed by the Commission.

▶ OSCAR E. HAUSER has been appoint senior engineer of the meter departme of the Detroit Edison Co. Mr. Haus became identified with the company 1908 as a meter inspector.

▶ BENJAMIN F. CONNOR, vice-presid of Colt's Patent Fire Arms Manufact ing Co., Hartford, Conn., has be named a member of the plastics, mo ders and fabrications industry advis committee of the OPA.

▶ S. J. TOMBAUGH has been appoint manager of the Toledo office of the G eral Electric Co. to succeed E. Howell recently made manager of t company's meter and instrument d sion. Mr. Tombaugh was formerly sales engineer in the company's Cle land office. He has been identified w General Electric since 1927.

▶ I. FRANK BROWNSON, regional c ordinator of the Westinghouse elect appliance division, has been appoint manager of the division's laundry equi ment department. Until the war en Mr. Brownson will continue d special contact work with governmen agencies at Washington in connect with the company's war programs. his post-war job will be to direct t manufacture and sale of Westingho laundry equipment.

▶ HARRY NEWCOMB, formerly v president in charge of the electric frigeration and gas water heater d sions of Servel, Inc., has been nam vice-president and assistant to the pr dent. NORTH I. TOWNSEND, form secretary and treasurer, has been m vice-president in charge of finance RUDOLPH SCHNAKENBURG, formerly troller, has been made secretary treasurer.

▶ FIRST LIEUTENANT WALTER SCHWARTZ, JR., president of Proc Electric Co., Philadelphia, has b awarded the Distinguished Flying C for gallantry in the Middle East a according to a recent announcement the Army Air Forces. The award presented "in recognition of extra

NOW'S THE TIME TO DRIVE FOR WAR BOND SALES

AS YOU NEVER DROVE BEFORE!

Many a soldier owes his life to a commander who drove him to the utmost a battle—*never let him slacken for a ngle fatal instant!* And after the war, any a worker will owe his economic fety to a leader who drove him ntinuously for higher Pay-Roll lotments for the purchase of War nds!

Despite higher taxes and prices, the erage worker still has more money an ever before—particularly on the sis of the *family* income. With others the family earning, too, just let the rker 'figure it out for himself', and usually will realize that *now* he can put more into War Bonds than he has been doing.

That's why the Treasury Department has set new quotas for the current Pay-Roll Allotment Drive—*quotas running about 50% above former figures.* These quotas are designed to reach the *new* money that's coming into the family income. Coming from millions of new workers . . . from women who never worked before . . . from millions who never before earned anything like what they are getting today!

The current War Bond effort is built around the *family* unit, and the Treasury Department now urges you to organize your War Bond *thinking*—and your War Bond *selling*—on the basis of your employees' *family* incomes. For details, get in touch with your local War Finance Committee which will supply you with all necessary material for the proper presentation of the new plan to your workers through your labor-management committees.

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. Great as this sum is, *it is not enough!* So turn-to today! Get this new *family income plan working!*

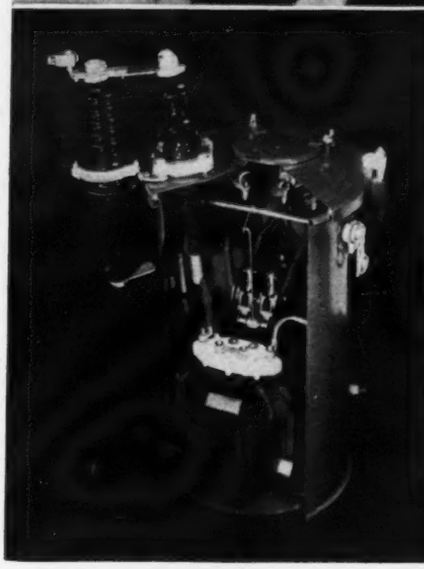
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

YOU'VE DONE YOUR BIT—NOW DO YOUR BEST

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

This Space Is a Contribution to America's All-Out War Effort By

ELECTRICAL WORLD



TO ASSURE
TIGHT CONNECTIONS
Leading Transformer Manufacturers use
DOUBLE LOCKING
PALNUTS

HERE'S WHY: Transformers are subjected to severe vibration during shipment from the factory. To prevent nuts from loosening, many transformer manufacturers apply Double Locking PALNUTS on top of regular nuts holding structural parts and electrical connections. This eliminates danger of nuts backing off and dropping into coils or tank—assures perfect electrical conductivity at all terminals.

The powerful double-locking action of PALNUTS may be judged by their wide usage today in Aircraft, Tanks, Jeeps, Military Vehicles and other war material . . . as well as all kinds of electrical and mechanical equipment.

Double Locking PALNUTS are single thread locknuts, made of tempered spring steel or Duronze. They are easily applied, light in weight, low in cost, require small space, may be removed and re-used.

Use PALNUTS on equipment you build —specify them on equipment you buy. Available from stock for all utility requirements. Write for Palnut Manual No. 1.

Double Locking Action

When the PALNUT is wrench-tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.

THE PALNUT COMPANY
51 Cordier St. Irvington, N. J.

Used Today on Aircraft, Tanks, Jeeps, Military Vehicles and other War Equipment

DOUBLE-LOCKING
PALNUTS

nary achievement while participating 200 hours of operational flights agai the enemy." Lieutenant Schwartz the son of Colonel Walter M. Schwar chairman of the board of Proctor Schwartz, Inc., of which Proctor El tric Co. is a division.

▶ GRAY H. BERNARD has been appointe works manager of the Eureka Vacuu Cleaner Co. in charge of purchasin scheduling and manufacturing. M Bernard was formerly manufacturin manager of the flying boat division Nash-Kelvinator, where he started s years ago as assistant to the vice-pres dent of the company.

▶ R. E. FIFE, tax agent, Southern Cal fornia Edison Co., has been appointe executive assistant and E. R. PETERSO has been named to succeed him as ta agent. G. R. WOODMAN has been a signed to the position of acting supe intendent of hydrogeneration. J. BRU has been appointed station chief Long Beach steam station and J. J McDADE assistant station chief.

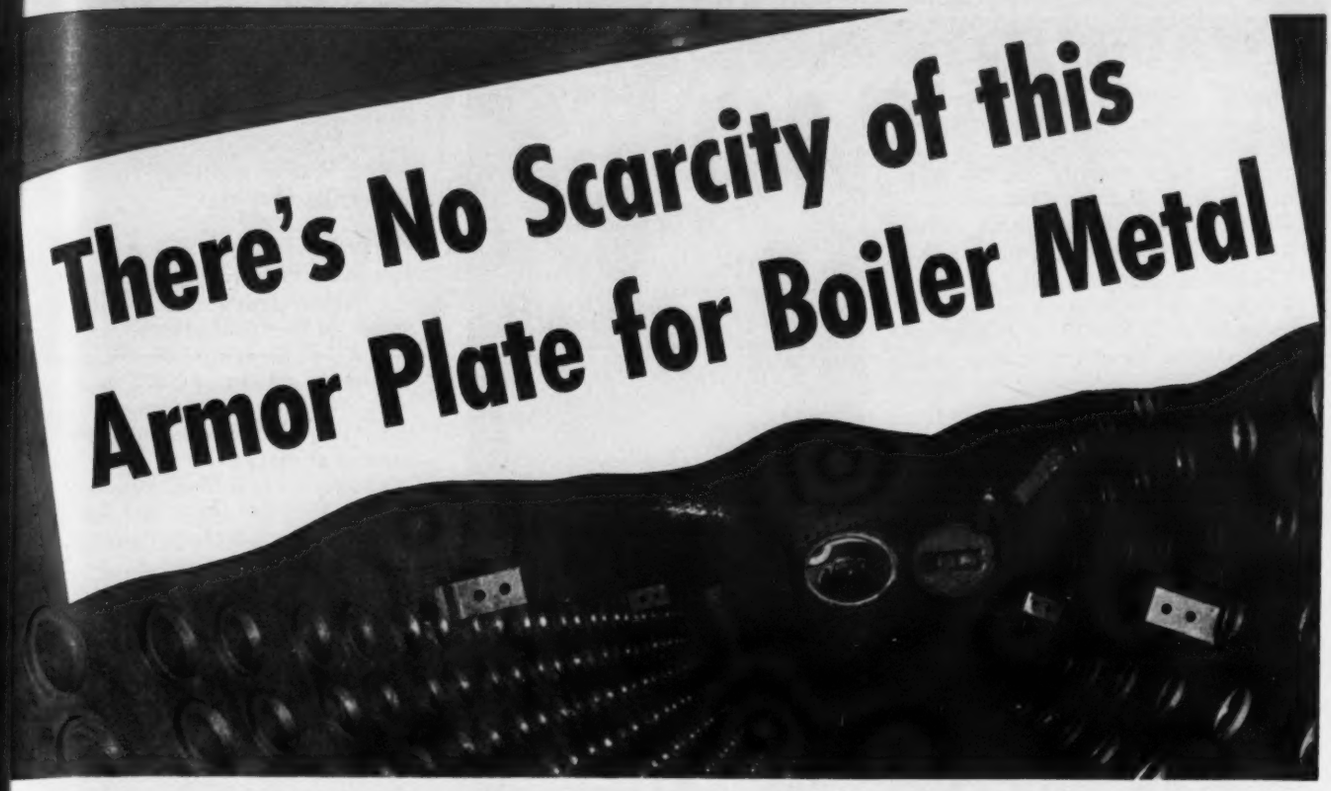
▶ ROY J. STANTON has been appointe motive power sales manager of th Gould Storage Battery Corp., Depew N. Y. Employed for a number of year by U.S.L., Mr. Stanton became a mem ber of the Gould sales force whe Gould took over the industrial divisio of U.S.L. He first covered several di ferent territories for Gould and finall assumed charge of the company's De troit office. In his new position he wil be located at Depew.

▶ KENNETH F. MILLER, formerly wit the Eastern Fixture Co., Boston, Mass and Champion Lamp Works, Lynn Mass., has been appointed sales man ager of the A. L. Smith Iron Co., Chel sea, Mass., maker of fluorescent lighting fixtures.

▶ LOWELL E. WHITE, formerly test pi lot for the Wright Aeronautical Corp has joined the research engineering staff of the C-O Two Fire Equipment Co., Newark, N. J.

▶ J. W. HACKETT has rejoined the sale organization of the Okonite Co. follow ing a two-year period as associate en gineer with the Corps of Engineers— War Department—and more recently with the Production Section Military Supplies (N. Y. district). Prior to his work with the Corps of Engineers, Mr. Hackett had spent 15 years with Okon ite as a specialist in the sale of in sulated wires and cables for the rail roads. A graduate of Worcester Poly technic Institute, Mr. Hackett's earlier background was obtained as appren tice engineer with the Union Switch &

There's No Scarcity of this Armor Plate for Boiler Metal



The metal in your boilers is worth its weight in gold, and when worn out, is practically irreplaceable. Yet power demands are increasing every day.

Here's the story of an essential maintenance, repair and operating material that will keep your boilers in service for years to come. It's available. It's economical. It's recommended by boiler insurance companies and endorsed by thousands of industrial power plants, utilities, railroads and marine operators. Even boilers about to be condemned have sometimes been cleaned, found in better condition than suspected, and given extra years of life with APEXIOR protection.

APEXIOR "Plates" Boiler Metal* for Resistance against Wear, Corrosion

Any boiler that can get an O.K. from inspection and a hydrostatic test is O.K. for plenty of war work, because the test strength can be maintained by applying, after cleaning, a durable coating of APEXIOR.

APEXIOR is brush-applied, by hand or power-coater. It forms a tough, impervious barrier against the water, and prevents corrosion for as long as 2 to 3 years (often longer), then can be easily renewed. Scale cannot form a tight bond with the APEXIOR surface — and is quickly removed with a wire brush.

Many more operators than ever before are using APEXIOR, but we have enlarged our facilities in order to help you overcome the problems of metal scarcity. APEXIORIZE — it's the quick, low-cost way of insuring your boiler life.

*Turbine metal, too. Some manufacturers coat shafts and rotor bodies and frequently the interior of casings of all turbines with APEXIOR before shipment to customers.

FREE BULLETINS 1290 (General), 1305 (Marine), Offer Aid to War Service Boilers.

Users like these have applied APEXIOR for years.

APEXIOR will help YOU get more service from irreplaceable equipment.

U. S. Army
U. S. Navy
U. S. Maritime Commission
U. S. Coast Guard
U. S. Bureau of Yards & Docks
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Cunard White Star, Ltd.

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A Peacetime Plus ★ ★ ★ A Wartime Must

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

The **DAMPNEY COMPANY**
of America
protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park, Mass.

Please send free Bulletin 1290 (General) ☐ 1305 (Marine) ☐ to:

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MARINE DEPARTMENT—*East Coast:* 114 Liberty Street, New York. *West Coast:* C. C. Moore & Co., San Francisco

"WATER-BOY"

Today, wherever our American Armies are fighting, there you'll find BEN-HUR Trailers—some carrying water, others heavily loaded with all kinds of fighting "cargo" . . . Standing up to the toughest travel, yet designed for easy loading.

The special designing and engineering skill and experience so long developed at BEN-HUR is YOURS to use now in developing your post-war product plans — particularly those involving material transport or providing easy mobility for special units.

Let's get together on some of these problems of yours. Our engineers will be glad to help you to profitable solutions in preparation for post-war markets.

BEN-HUR MANUFACTURING CO.

634 East Keefe Avenue, Milwaukee 12, Wisconsin

ARMY E NAVY

Awarded to Ben-Hur for Outstanding War Production

BEN-HUR **INDUSTRIAL TRAILERS**

VICTOR INSULATORS INC

VICTOR, NEW YORK

The Mark of Good Insulators . . .

Signal Co., as an engineer in the signal department of the New York Central Railroad, and later with General Railway Signal Co.'s predecessor, the old Federal Signal Co. It was following World War I that Mr. Hackett first joined Okonite.

► DAN SCHAITBERGER has been appointed sales manager of the Northern Engineering Works, Detroit, Mich., maker of electrical cranes. Mr. Schaitberger has been with the company for 16 years, starting in 1927 as a salesman. Previous to this recent appointment he had been sales engineer for a number of years.

► L. E. HAMMER has joined the Worthington Pump & Machinery Corp., as assistant works manager of its Moore steam turbine division, Wellsville, N. Y. A graduate of the University of Pittsburgh, Mr. Hammer obtained his experience chiefly in the field of steam turbine manufacture.

► FREDERICK W. BLISS, sales development manager, General Electric Co., Boston, and past-president of the Engineering Societies of New England, Inc., has been elected president of the Boston Advertising Club.

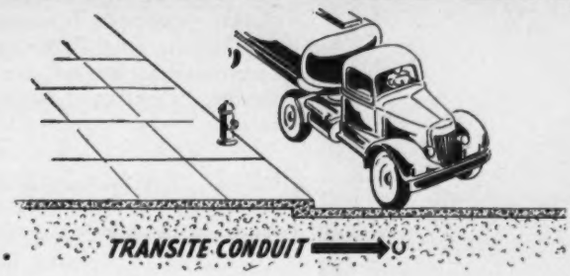
► R. W. GEMMELL has been named manager of the aviation section, industry engineering department, Westinghouse Electric & Manufacturing Co., and W. A. MECHESNEY has been made manager of the aviation section under the industrial department. The appointments followed the recent formation of an aviation section. Mr. Gemmell will handle engineering problems connected with the aviation industry, while Mr. Mechesney will supervise commercial problems involving the application of Westinghouse products to that industry. Mr. Gemmell has been with Westinghouse since 1926 and Mr. Mechesney since 1937.

► E. PERRY HOLDER, president of the Vulcan Iron Works of Wilkes-Barre, Pa., has been elected president of the Wickwire-Spencer Steel Co. Mr. Holder succeeds E. C. BOWERS, who resigned as president because of serious illness, but will remain as a member of the board of directors and the executive committee and act in an advisory capacity.

► WILLIAM J. CONLEY, formerly chairman of the engineering department of the University of Rochester, has been appointed consulting engineer of Lincoln Electric Co., Cleveland, Ohio. He will act as a welding consultant for various industries, handling problems on mechanical and structural design utilizing welding, as well as metallurgical

WHY TWO TYPES OF TRANSITE DUCTS?

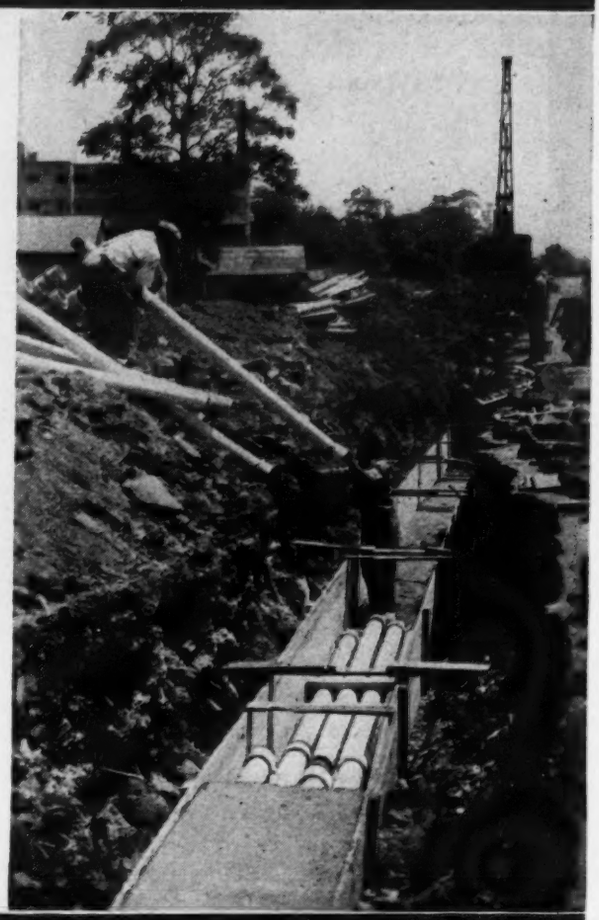
For Use Without a Protective Envelope . . .



Transite Conduit saves on labor and material, for it is so strong it needs no protective casing. It maintains its strength and true form under heavy earth loads and traffic pressure. Can't rot . . . effectively resists soil corrosion, smoke and fumes.

For Use With a Protective Casing . . .

Transite Korduct is thinner walled, lower priced, otherwise identical with Transite Conduit. Its long lengths mean fewer joints, fewer spacers. And its unusually high rate of heat dissipation lowers cable operating temperatures, boosts system capacity.



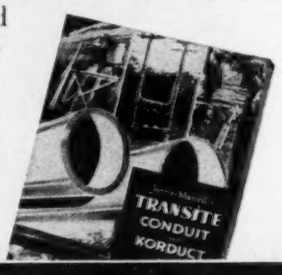
BOTH THESE DUCTS PROVIDE THESE ADVANTAGES AS WELL . . .

1. Minimize fire hazard—Transite Ducts cannot burn because they are made of asbestos and cement. They will not contribute to the formation of explosive or combustible gases.

2. Eliminate electrolysis problem—Inorganic and non-metallic, Transite Ducts can never be affected by electrolytic action.

3. Make cable pulls easy—The smooth bore of Transite Ducts speeds up cable installation. Because the ducts stay smooth in service, cables can be removed and replaced at any time with virtually no damage to sheathing.

4. Save time on installation—Light in weight, supplied in long lengths, Transite Ducts are so easy to assemble that only the minimum of time and expense is required for any job. Write for Data Book DS-410, Johns-Manville, 22 E. 40th St., New York 16, N. Y.



JM Johns-Manville

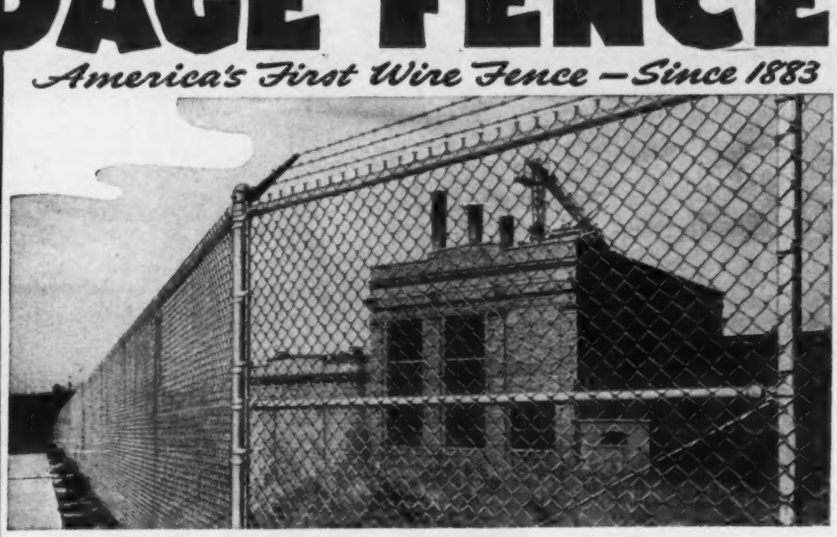
TRANSITE DUCTS

TRANSITE KORDUCT— for installation in concrete

TRANSITE CONDUIT— for exposed work and installation underground without a concrete encasement

PAGE FENCE

America's First Wire Fence — Since 1883



Protect Your Protection!

● Your fence is now "critical material." Because replacement may not be possible for some time to come, you will be wise if you have your present fence inspected now and serviced expertly by Page-trained men. Their long, specialized experience and their knowledge of localized conditions affecting fence metals, qualify them to extend the protective life of your fence. Write for name of nearest Association member and discuss fence servicing with him. Address PAGE FENCE ASSOCIATION, Headquarters: Monessen, Pa.

PRODUCT OF PAGE STEEL & WIRE DIVISION • AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONN.

JAMES KNIGHTS *Crystals*

When the new developments of this emergency period are available, and you re-equip completely with modern communications systems, remember that you cannot buy better crystals than those produced by The James Knights Co. The men of The James Knights Co. are pioneers in the radio crystal field.

PRECISION CUTTERS OF QUARTZ
for
COMMUNICATIONS & OPTICAL USES

The *JAMES KNIGHTS* Co.
SANDWICH, ILLINOIS

problems involving welding processes. In connection with his new work, Mr. Conley will have charge of the company's welding educational activities. He is a member of the American Welding Society, American Society for Metals, American Institute of Mining and Metallurgical Engineers, American Electroplaters Society and the Society for the Promotion of Engineering Education.

► Z. G. TAYLOR has been appointed manager of the East Cleveland (Ohio) lamp works war plant of the General Electric Co., succeeding W. B. GILLEN, who has resigned as manager of the plant to become manager of manufacturing for G.E.'s newly formed tube division of electronics department. Mr. Taylor has long been engaged in General Electric's lamp-making activities. Mr. Gillen was made manager of the East Cleveland plant in 1942. For the present he will make his headquarters at Nela Park, Cleveland.

► JOHN J. NIELSEN, an application engineer, has been named plastics specialist for the Los Angeles area by the Westinghouse Electric & Manufacturing Co. Announcement of the appointment was made recently by Clyde H. Wood, of San Francisco, manager of the company's agency and specialities division for the Pacific Coast district. Mr. Nielsen was transferred to Los Angeles from Trafford, Pa., where Westinghouse manufactures Micarta, a laminated phenolic plastic. He has served the company as an application engineer in Pittsburgh, Pa., Philadelphia, Pa., and Baltimore, Md., since 1929.

► WILLIAM J. PIPER has been appointed assistant superintendent of meters of the Detroit Edison Co. Mr. Piper was employed by the company in 1923 as a technical engineer in the meter department.

► C. H. LINDER has been appointed assistant manager of General Electric Co.'s Schenectady Works. Mr. Linder has been assistant to J. M. Howell, works manager, since January 1, 1942.

► PAUL DIETZ has been recently appointed export sales manager for the general machinery division of the Allis-Chalmers Manufacturing Co. He will take the position left vacant by the death of Harlow Bradley. Mr. Dietz joins Allis-Chalmers after a connection with the export division of the B. F. Goodrich Co., Akron, Ohio. During the 15 years he was with Goodrich Mr. Dietz was stationed in Mexico, China and French Indo-China. He was in

Hong Kong when it fell to the Japanese, returning to this country following negotiations between the State Department and the Japanese government. Following graduation from Miami University at Oxford, Ohio, he spent a year at the Frederick Wilhelm University in Breslau, Germany, as an exchange scholar for the Institute of International Education of the Carnegie Foundation.

OBITUARY

▸JOHN A. PLEDGE, 41, sales engineer for the General Electric Co. at Richmond, Va., died September 1 in a local hospital. Mr. Pledge was educated at Baltimore Polytechnic Institute and Johns Hopkins University, Baltimore.

▸JAMES E. ARTHUR, 74, retired power sales engineer of the Boston Edison Co., died at Miami, Florida, on August 29th. During World War I he was loaned to the United States Government as a power expert. Mr. Arthur retired eight years ago.

▸JAMES E. MCMAHON, 49, manager of the Water-Fog Sales Department of the Rockwood Sprinkler Co., Worcester, Mass., died in that city September 1. He was formerly sales manager of the Grafton and Knight Co., Worcester.

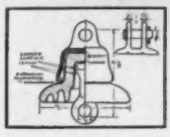
▸JOHN E. HAYWARD, 68, comptroller, assistant treasurer and a director of the Washburn Wire Co., Phillipsdale, R. I., died recently at Providence, R. I., after a short illness. He was born in Providence and in his early career was employed in the accounting department of the American Electrical Wks., Phillipsdale, prior to merger with the Washburn company.

▸ERNEST J. BERGGREN, who was believed to be the last survivor of the Edison pioneers, died in Schenectady, N. Y., on September 9 at the age of 80. Born in New York, Mr. Berggren joined the Edison interests in Menlo Park, N. J., in 1880. When the Edison Machine Works, organized in 1881, moved from New York to Schenectady in 1886 he moved with it. He became head accountant of the Edison General Electric Co. in 1889, and, after a merger created the General Electric Co., he was head accountant of its Schenectady plant from 1892 to 1910. Mr. Berggren was secretary-treasurer of Thomas A. Edison, Inc., in Orange, N. J., from 1910 until he retired in 1924. He played an important part in the restoration of the Menlo Park laboratory for Henry Ford's collection at Dearborn, Mich.

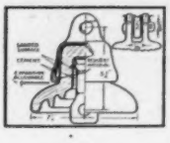
Pinco Suspension Insulators

(Types allowed under WPB Limitation Order L154 Schedule V)

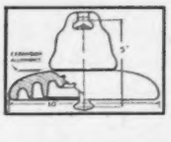
Provide 7 "Right on the Job" answers to your Suspension Insulator Problems



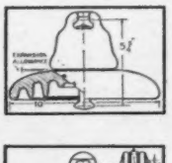
1510—For distribution and rural dead-ends. Flashover, volts, dry — 60,000; wet — 30,000. M. & E. rating, lbs.— 10,000. Leakage distance, 7".



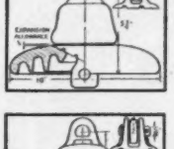
600—For distribution and rural dead-ends. Flashover, volts, dry — 65,000; wet — 35,000. M. & E. rating, lbs.— 15,000. Leakage distance, 8¼".



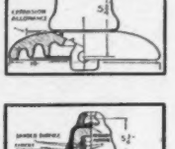
1900—For standard transmission use. Flashover, volts, dry — 80,000; wet — 50,000. M. & E. rating, lbs. — 15,000. Leakage distance, 11½".



1060—For standard transmission use. Flashover, volts, dry — 80,000; wet — 50,000. M. & E. rating, lbs. — 15,000. Leakage distance, 11½".



1070—For standard transmission use. Flashover, volts, dry — 80,000; wet — 50,000. M. & E. rating, lbs. — 15,000. Leakage distance, 11½".



1570—For high strength dead-ends. Flashover, volts, dry — 80,000; wet — 50,000. M. & E. rating, lbs. — 25,000. Leakage distance, 11".

1925—For fog or contaminated conditions. Flashover, volts, dry — 80,000; wet — 60,000. M. & E. rating, lbs.— 15,000. Leakage distance, 16".

IN compliance with WPB limitations, Pinco Suspension Insulators are now limited to the models shown here. These are not new models, but represent types that have long been standard with Pinco users . . . time tested and service proved on lines in all parts of the country. Like all Pinco Insulators they are made of Pinco High Test Porcelain, jig-assembled to the closest tolerances, thoroughly tested and inspected to provide long, uninterrupted "*right on the job*" service.

THE PORCELAIN INSULATOR CORPORATION
646 MAIN STREET • LIMA, NEW YORK

An all porcelain tree insulator of new design that eliminates the need for costly tree trimming operations and provides better electrical and mechanical protection. Line and laboratory proved.

★ **PINCO INSULATORS** ★

Pinco Standard Insulators are cataloged in the Electrical Buyers' Reference.

SALES AGENTS—The Jodyn Company—New York, Rochester, Philadelphia, Baltimore, Lynchburg, Va.; Jobbers Supply Co.—St. Paul, Portland, Seattle; Jodyn Co. of California—Los Angeles, San Francisco, Phoenix, Ariz.; Southern Jodyn Co.—New Orleans; H. E. Burns Co.—Pittsburgh; J. J. Costello—Boston; Southeast Jodyn Company—Cincinnati, Cleveland, Westerville, O., Lexington, Ky., Atlanta, Jacksonville; Paul Doudan—Denver; Paul Corson—Amarillo, Texas; Jodyn Manufacturing & Supply Co.—Chicago, Springfield, Ill., Kokomo, Ind., Kansas City, Omaha, Oklahoma City; Jodyn Southwest Co.—Dallas, Houston.

MANUFACTURING-MARKETS

Sees Export Boom in Electric Appliances

To meet a "tremendous upsurge in the demand for household appliances all over the world" immediately after the war, a much larger percentage of American production will be required for the export trade than prevailed before the war, according to Roy W. Gifford, vice-president and assistant general manager of the Norge Division of Borg-Warner Corp., who has just completed a survey of distributor reports from various countries. Shipments will begin just as soon as large scale post-war production has met the urgency of domestic requirements, he said.

"American military infiltration and occupation of many countries in this global war is laying the groundwork for big markets after the war," Mr. Gifford continued. "For example, the American occupation of northern Africa will open an important new market on a scale much larger than before the war. The people are learning to like American ways and equipment. The same is true of Sicily and will apply to others. The need for replacing and equipping many thousands of homes and other property destroyed by war will be stupendous."

Mr. Gifford believes that several countries, such as Newfoundland, will prove a better market for household appliances because they have been "opened up" by new roads and airports built for military uses.

"The Latin American countries, particularly Brazil, Bolivia, Venezuela, Uruguay and Ecuador, will be big markets and the Dutch West Indies will buy large quantities of American home appliances," he said.

•

Storage Battery Sales in Canada Increase

Sales of electric storage batteries and parts by principal Canadian producers were valued at $2,164,541 during the second quarter of 1943, compared with $1,959,432 in the previous quarter and with $1,380,480 during April, May and June of 1942, according to the Dominion Bureau of Statistics.

Sales for the quarter under review included 251,894 batteries at $1,219,209 for the ignition of internal combustion engines, 1,506 batteries at $5,567 for motor cycle starting, 7,897 cells at $51,128 for farm lighting plants, 1,894 cells at $36,966 for railway service, batteries valued at $561,794 for other purposes, including those for telephone switchboards, and miscellaneous parts and supplies for batteries valued at $289,877.

•

Formica Opens Wartime Employment Office

Formica Insulation Co., Cincinnati, has opened an emergency wartime employment office in the heart of Cincinnati's shopping and amusement district as a means of facilitating applications and conferences from prospective employees.

"Ellsworth G. Williams, vice-president in charge of manufacturing for the company, said: "We are trying out the midtown employment center as an auxiliary to our regularly established personnel department at the plant, in hopes of enrolling much-needed manpower and women workers to help out in the war effort on the civilian home front."

"Buy a Bond—Get on the Bond Bomber" is the theme for the Third War Bond drive sponsored by the company. The drive, conducted by a management-labor committee, was stimulated by display of the theme poster on bulletin boards throughout the plant.

•

Philco Shipments at Record Volume

In a letter to stockholders this week, John Ballantyne, president of the Philco Corp., reports that July shipments were the highest on record, with further gains expected during the remainder of the year. Shipments consisted mainly of radio and electronic equipment for the armed forces.

Renegotiation of 1942 contracts has been completed, resulting in an adjustment of $220,350 in earnings, which was charged to the $1,000,000 reserve for contingencies, the report revealed. The reserve is now $779,650, leaving $2,209,992 profit, or $1.61 per common share, as originally reported. A voluntary reduction of $5,000,000 was made in prices of military equipment sold to the Army and Navy last year.

Profit for the first half of 1943 was $1,526,282, or $1.11 per common share, against $1,152,877 adjusted profit, or 84 cents a share, in the similar period of 1942.

APPLIANCE REPAIR SCHOOL—Many utilities are sponsoring Westinghouse "Conservice" schools, at which the making of simple appliance repairs is taught. At this recent school session in Oakland, Calif., men and women of all ages were given a lesson in cord maintainance

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

"These boats are designed to strike and strike hard, to do damage where it will do the most good and quickly."
Such was the description
two sub-chasers today being fit-
ted for service at Shelburne Har-
SC1030

"Electrical fittings by Wesco"—190 of them

Products of 45 Manufacturers Assembled to Speed Historic Sub-Chaser Launching

When two 110-foot sub-chasers hit blue water recently, it was the first launching of combat vessels on Lake Champlain since the year 1812. Each sub-chaser's electrical fittings consisted of 190 separate items, ranging from a door switch to an automatic alarm system. Products of 45 manufacturers were involved.

Wesco ordered, assembled and delivered each set of 190 units—built to Navy specifications—before the deadline date. With Wesco as sole source of supply, complications, errors and expense were saved. The customer's office procedures were simplified by the elimination of 45 separate orders, 45 acknowledgments, 45 checks and countless follow-ups, bills of lading and invoices.

Once more, Wesco, trained in the quick assembly and delivery of every type of electrical product, helped speed war production. After Victory, this service-ability will again be yours to command as you convert to the business of peace.

WESCO SPEEDS WAR PRODUCTION

* On the frigid Northwest Coast 16 floodlights were urgently needed for lighting emergency airfields. The manufacturer required 10 weeks to make delivery. Wesco had the equipment on the way in 18 days.
* A flood ruined the machinery and electrical equipment of an important war plant. Wesco's prompt delivery of 22 electrical items made by 6 manufacturers saved this plant 28 days delay.

WESCO SERVES BUSINESS

* By offering prompt delivery of electrical items from local stocks.
* By maintaining perpetual inventory records.
* By providing trained sales and engineering personnel.

Westinghouse Electric Supply Co.

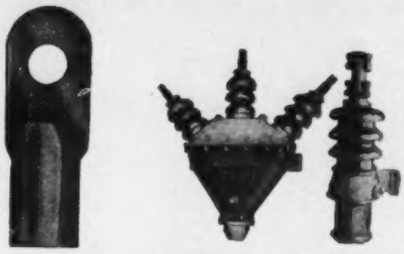
150 VARICK STREET . . NEW YORK (13), N. Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

FOR QUICKER EASIER TRIMMING WORK
use SEYMOUR SMITH TOOLS...
TREE TRIMMERS
POLE SAWS
BRUSH CUTTERS
CABLE CUTTERS
JOINTED TEST-PIKE POLES
A line of tools designed for linemen's use that are standard equipment with the world's largest Utility Companies.
Send for folder and prices of this labor saving equipment.
SEYMOUR SMITH & SON, Inc.

ELECTRICAL SPECIALTIES
FOR HEAVY INDUSTRIAL SERVICE
FROM STOCK

RMT



Dash Nos. 1-10 Soldering Lug

3-Conductor Angle Shape B Pothead and Single Conductor Pothead

Write for a complete selection of RUSGREEN bulletins

ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

RUSGREEN MFG. CO.
14260 Birwood Avenue • Detroit, Mich.

Please Be Patient

WE'RE SORRY. We know you may not be receiving your copy of ELECTRICAL WORLD on time and, wherever the trouble is within our own walls, we're turning handsprings to correct it. But much of the difficulty is entirely beyond our control, especially transportation. We are using special expediters to co-operate with the Post Office and the railroads, but that has merely kept deliveries from being worse than they are.

It isn't only the shipping out of the magazines, but the shipping in of paper, the shipping of engravings and proofs—a delay in any one of which means a delay of the whole product. And when a magazine is not ready another one takes its place on the press, with the result that it must then wait until a press is free. In other words, delays in printing these days are pyramided.

It is terribly embarrassing to have to acknowledge these delays because we have always prided ourselves in "coming out" on time, regardless. We will still do everything possible to try to improve conditions, but in the meantime we ask you to remember that both the railroads and the Post Office have had a tremendous load placed on them and are doing extraordinary jobs. We'll all do our best—please be patient with us.

Westinghouse Extends New Nutrition Servic

To help appliance retailers, furnitur stores and department stores provide wartime food information service an build customer good will, the Westing house Electric appliance division is ex panding the distribution of the Healt for Victory Meal Planning Guides.

Now used by more than half a mi lion housewives throughout the nation the monthly Meal Planning Guides ar being made available, beginning i October, to furniture stores, depart ment stores and thousands of applianc retailers, T. J. Newcomb, sales manage of the Westinghouse Electric applianc division, has announced.

The guides contain 68 pages of timel food information every month.

•

Line Material Dividend

Line Material Co. has declared a common dividend, first of the year, o 20 cents a share. It paid 15 cents i August, 20 cents in November and 1 cents in December, last year.

•

Manufacturers Make Sales Assignments

The following appointments have re cently been made by manufacturing companies to their sales staffs:

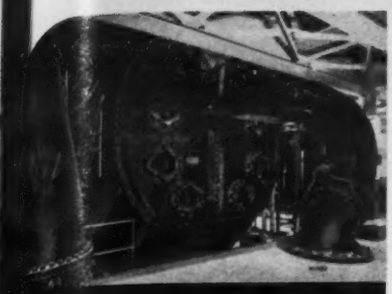
Lincoln Electric Co. has recently ap pointed H. E. Cable, welding engineer, a representative in the Pittsburgh territory Mr. Cable will assist W. R. Persons, Pitts burgh district manager of Lincoln Electric.

Increased business has necessitated th opening of additional Dow Chemical Co. offices in the eastern area. Clayton S. Shoe maker has been appointed eastern sales manager and Frederick A. Koch has been made assistant eastern sales manager. Ralph E. Dorland, who has been manager of the New York office for several years, will remain in that capacity, not being desirous of taking over the heavy responsibilities of opening additional offices. Mr. Shoemaker has been associated with Dow for a number of years and has occupied various sales executive positions with the company. Mr. Koch has been assistant manager of the New York sales office for 15 years. Announcements will be made in the near future on the opening dates of new offices in Boston and Philadelphia. Alexander Leith, Jr., has been made manager of the Philadelphia office and Alfred A. Lawrence manager of the Boston office. Both Mr. Shoemaker and Mr. Koch will make their headquarters at 30 Rockefeller Plaza, New York.

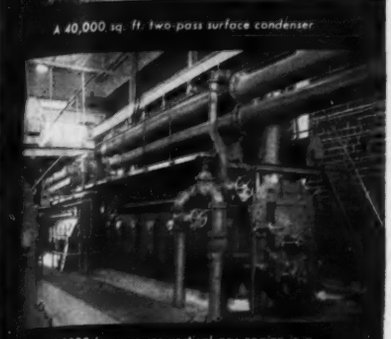
Appointment of H. D. Siler as manager of the New York office has been announced by the Pittsburgh Reflector Co., Pittsburgh, Pa. Mr. Siler joined Pittsburgh Reflector in 1940 as illuminating engineer of the New York office. Prior to that he spent ten years in sales, sales promotion and engineering for Ohio Bell Telephone Co. and Columbus Railway, Power & Light Co.

WORTHINGTON

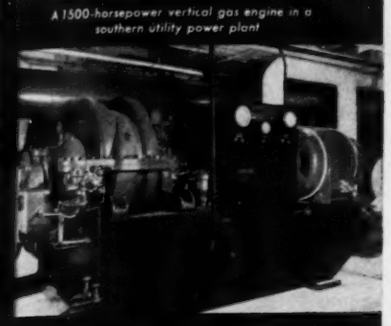
EQUIPMENT FOR UTILITY POWER



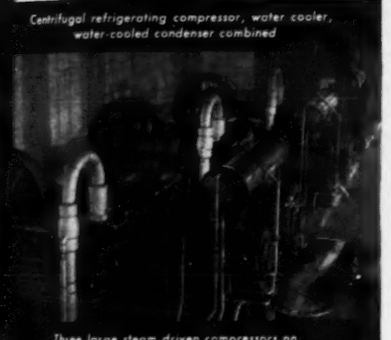
A 40,000 sq. ft. two-pass surface condenser



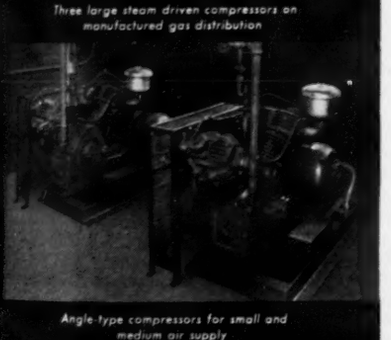
A 1500-horsepower vertical gas engine in a southern utility power plant



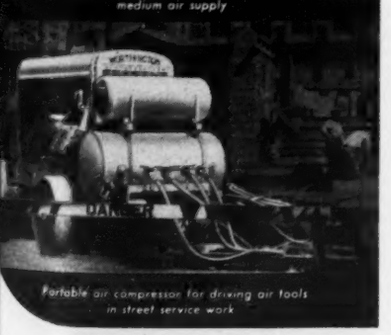
Centrifugal refrigerating compressor, water cooler, water-cooled condenser combined



Three large steam driven compressors on manufactured gas distribution



Angle-type compressors for small and medium air supply



Portable air compressor for driving air tools in street service work

STEAM TURBO-GENERATOR UNITS
All types up to 7500 kw.

MULTI-STAGE STEAM TURBINES
All types 25 hp. to 10,000 hp.

SINGLE-STAGE STEAM TURBINES
Up to 2500 hp.

COMBINED STEAM TURBINE AND REDUCING GEAR UNITS
5 hp. to 200 hp.

REDUCING AND INCREASING GEARS

DIESEL ENGINES
150 hp. to 1500 hp.

GAS ENGINES
175 hp. to 2880 hp.

CONVERTIBLE GAS-DIESEL ENGINES
150 hp. to 1500 hp.

STEAM CONDENSERS
Of all capacities, with all auxiliaries.

STEAM-JET EJECTORS
For moderate to high vacuum service.

CENTRIFUGAL BOILER FEED PUMPS
For medium and high-pressure service.

CENTRIFUGAL GENERAL SERVICE PUMPS
For every required application.

AIR AND GAS COMPRESSORS
For small, medium and large air supply. Steam, motor or engine driven.

FEEDWATER HEATERS AND DE-AERATORS
Open type, for individual requirements.

WATER PURIFICATION EQUIPMENT
Softeners and filters.

REFRIGERATING AND AIR CONDITIONING EQUIPMENT

TURBINE WELL PUMPS
For general, sump and other services.

STEAM, POWER AND ROTARY PUMPS
For boiler feed and varied services.

LIQUID METERS
All types; hot or cold water, chemicals, etc.

V-BELT DRIVES
Complete drives, sheaves or belts only.

PORTABLE COMPRESSORS AND AIR TOOLS
For new construction and maintenance service.

A complete coverage for every important power plant function

WORTHINGTON PUMP AND MACHINERY CORPORATION

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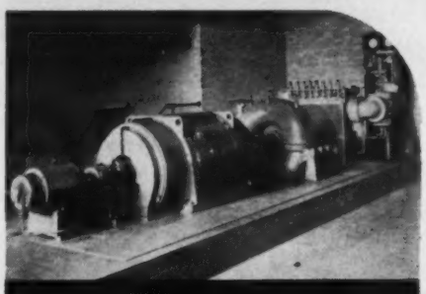
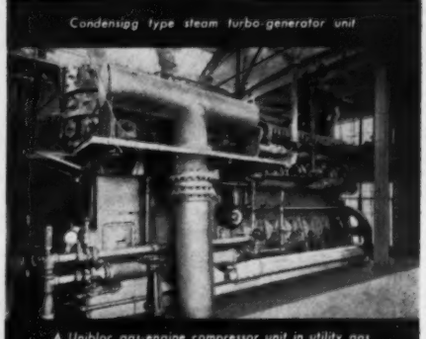
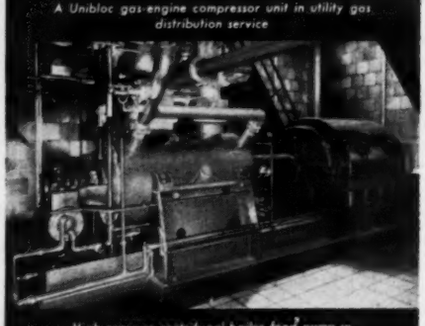


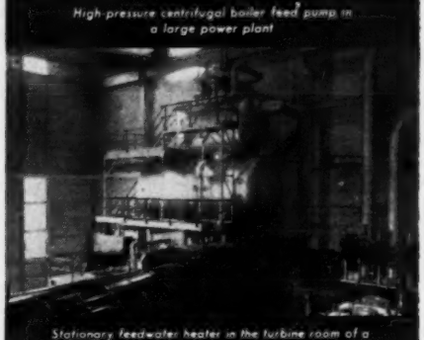
Condensing type steam turbo-generator unit



A Unibloc gas-engine compressor unit in utility gas distribution service

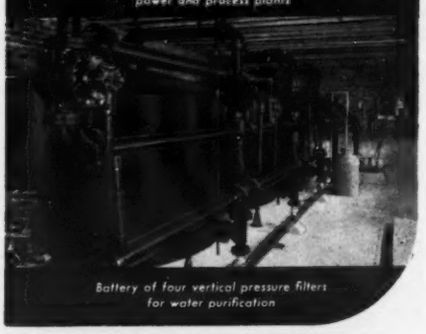


High-pressure centrifugal boiler feed pump in a large power plant



Stationary feedwater heater in the turbine room of a large public utility power plant

Steam-jet air ejectors for high vacuum service in power and process plants



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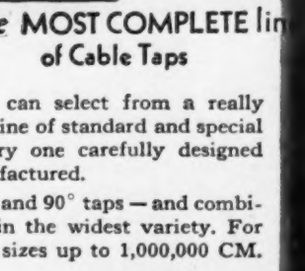
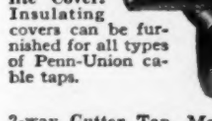
Now you can select from a really *complete* line of standard and special taps. Every one carefully designed and manufactured.

Parallel and 90° taps — and combinations — in the widest variety. For conductor sizes up to 1,000,000 CM.



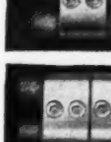
Gutter Tap with Bakelite Cover. Insulating covers can be furnished for all types of Penn-Union cable taps.

2-way Gutter Tap. Main and branch sizes 8 to 1,000,000.

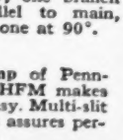


Two Separate Parallel Taps to a continuous main conductor.

Combination Cable Taps; one branch parallel to main, and one at 90°.



Hinged Clamp of Penn-Union Type HFM makes installation easy. Multi-slit tapered sleeve assures permanent grip on branch.



Positive Equalized Pressure on main and branch, with Penn-Union Type SM. Tightening torque is accurate measure of the clamping force.

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Conductor Fittings

Field Reports on Business

Reports indicate that industrial output is on a high level of activity, but problems of manpower and materials continue to infest management. In the electrical field wiring supplies for cargo ships and for rural line repairs are very active. Considerable new housing is reported.

NEW ENGLAND

Boston Edison is relocating a 12,500-kva. phase-angle, regulating transformer for its Mystic station and two 33,000-kva. 3-phase step-up transformers are being installed at this plant. A prominent manufacturer has been awarded naval electric cable orders aggregating over $4,000,000. Aerovox Corp. capacitors are being turned out at a good rate for the Navy; electrical heating units are in demand, and wiring supplies for the light and power in cargo ships now being built are very active. Wiring supplies needed for repair of electrical apparatus in rural districts are moving ahead. One contractor reports a steady demand for reconditioning of farm electrical equipment including pumping units, lighting, and domestic appliances and reports better prospects for the release of much needed supplies as a result of the new CMP Regulation No. 9 issued by the WPB.

National Housing Agency has named Boston a housing shortage area and authorized the conversion of private homes to provide additional apartments for war workers of the Fore River and Hingham ship yards. This move should stimulate supplies for household service as the program calls for renovations and alterations on a fair-sized scale. Two hundred privately financed conversions and 200 publicly financed units will be begun at once. Hartford's use of industrial electric power has increased 193 percent since 1939. A destroyer and two escort vessels were scheduled to be launched by the Bath (Me.) Iron Works on September 11, and a submarine at the Electric Boat Company's yard at New London on the 12th.

Engineer contracts under the supervision of Army engineers have been awarded for the construction of temporary buildings in Massachusetts and New Hampshire calling for the expenditure of about $30,000 for each. Much idle capital will be available when resumption of production for civilian needs comes. One prominent manufacturer is taking steps in the direction of contacting representative plants with the view of co-operating in any changeovers likely to come in the advent of a sudden lessening of government demands.

CHICAGO

Although problems of manpower, materials and production continue to dominate the management mind as war orders and output in this area mounts to record levels, plans for the future are inching their way into prominence, particularly in consumer goods industries.

"Plan but don't crystal gaze"—"trouble lies ahead if the public expects too much" were typical post warnings of one radio manufacturing executive. "Let's recognize," he urged, "that change will continue to come about through evolution rather than revolution."

A heavy post-war schedule in diesel engine production was foreseen for General Motors Electro-Motive Division reported last week as having $105,000,000 worth of diesel-electric locomotive orders awaiting filling, not including heavy Navy orders. On current locomotive orders alone 24,269,387 manhours of work will be needed—more than was spent on locomotive production in the last three years.

After a let-down in late July and early August the volume of prime contracts awarded to Chicago industries has increased steadily. During the week ending September 2, seventy-two local firms received government war contracts totaling $5,695,000. During the week ending September 9, however, 91 firms received prime contracts aggregating $7,945,000.

PACIFIC COAST

New industrial developments cover a four-story packing plant for Seattle; new warehouses for Western Pipe & Steel Co. at south San Francisco; enlargement of Goodrich plant in Los Angeles; additional Liberty ships awarded Oregon Shipbuilding Corp. at Portland, with smaller awards among various Puget Sound yards and new food mills and dehydrators in Burley, Idaho, and San Joaquin Valley.

Extensive irrigation from the Humboldt River is planned for eastern Nevada near Lovelock.

Orders include $3,706 of circuit breaker parts for Bonneville; a transmission line and distribution system for enlarged government installation at Wendover, Utah; poles and line material for Roseville, Calif.; ninety 3 hp. motors and controls, costing $20,000 capacitors and primary cutouts, costing $22,000, and a 45-ton diesel electric G. E. locomotive for an aggregate plant.

El Centro is considering purchase of existing electrical properties in Imperial Valley and their betterment for a total cost of $6,000,000. A new power plant at Pilot Knob on the All-American Canal is also contemplated.

Considerable new housing is reported in California and Washington and in the vicinity of various plants in Colorado and Oregon.

NEW YORK

Both industrial and retail trade reports in the New York area continue to reflect favorable levels of activity.

Consolidated Edison Co. reports electric output for the week ended August 29 amounted to 205,200,000 kw.-hr., an increase of 30 percent over the corresponding 1942 week. Local distribution was up 40.6 percent.

Department store sales nationally for the week ended September 4 were unchanged from the levels prevailing in the same week in 1942, but the four-week period showed a gain of 5 percent, despite increasing shortages of consumer goods and shrinking inventories. For the latest week, the Federal Reserve Board figures showed New York off 2 percent; Boston off 3 percent and Philadelphia off 5 percent.

Engineering construction awards for the holiday-shortened Labor Day week totaled $36,606,000, 62 percent below the corresponding 1942 week, and compares with $61,674,000 reported for the preceding week by *Engineering News-Record*. The current week's construction brings the 1943 total volume to $2,322,368,000 which, on a weekly average basis, is 67 percent below the $7,278,879,000 reported for the 37-week period in 1942.

Chinese Engineers Seek Utility Jobs

Six Chinese engineers, driven from their homeland by the war, are seeking "duration" jobs with electric companies in the United States.

The six refugees, two of whom did graduate work at American universities and all of whom hold bachelor of science degrees from Chinese universities, are completing training courses with the Tennessee Valley Authority and will be available for service of a year or longer late this year.

At the request of the Foreign Trade Office of the National Resources Commission, the Council of Electric Operating Companies is endeavoring to place these men, whose principal aim is to obtain as broad experience as possible in specified phases of electric utility operation.

These men are in the United States, according to CEOC officials, because the communities in which they served in China have been occupied. They plan to stay here until they can return to China. Salary is of secondary importance, according to the National Resources Commission, with the Chinese government pledged to meet their subsistence and incidental expenses if their remuneration is insufficient to do so. It has been suggested that they be paid salaries commensurate with whatever duties they may be assigned.

The men range in age from 30 to 36 and in experience from seven to fourteen years. Four are electrical engineers, one a civil and the other a mechanical engineer. One did graduate work in engineering at Harvard, another at the California Institute of Technology. They are specializing in hydro power plant civil engineering, power distribution and sales, power distribution substation work and electric power plant engineering. At TVA most of them are getting experience in power plant design, construction and operation. Only one is reported to have language difficulties.

•

Rejects Option to Purchase Light Plant

The city commission of Dade City, Fla., voted recently to abide by the opinions of residents and will not exercise its option to purchase the electric light plant from the Tampa Electric Co.

The city holds an option to purchase the plant for municipal operation every five years. With the option date again approaching, a mass meeting was called at the city hall by the commission. Residents expressed satisfaction with

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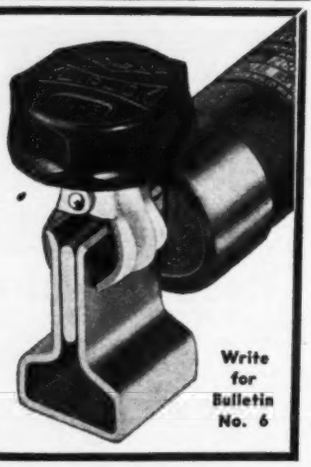

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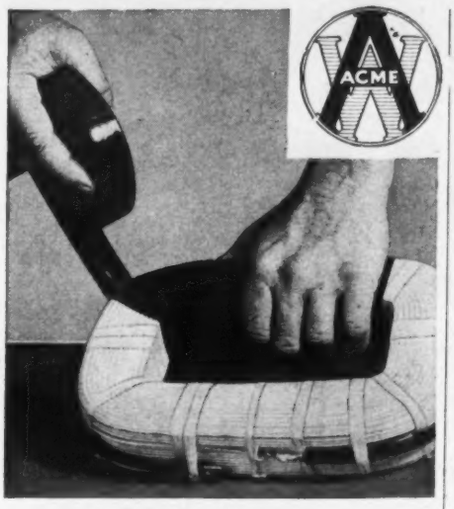

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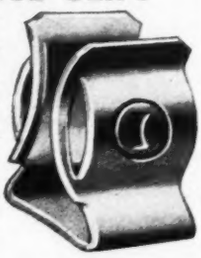

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CINCINNATI, OHIO

the rates offered by the Pasco county division of the company and objected to the city going into debt for the plant at this time. The commission immediately voted to abide by the expressed opinions.

•

Bendix Will Redeem All Class A Stock

Bendix Home Appliances, Inc., of South Bend, Ind., has notified class A stockholders of the proposed redemption of all the 21,007 outstanding shares of this class on or before November 30, 1943.

J. S. Sayre, president, said consummation of this plan will result in the elimination of all debt and capital with the exception of the common stock. During the past two years, he said, the company has retired an $80,000 mortgage on the plant, $508,000 of 5 percent convertible debentures and 53,815 class A shares, while an additional 47,018 class A shares were converted into 141,054 shares of common stock.

"Due to the war and the restrictive order of the WPB requiring us to stop production of the Bendix Automatic Home Laundry, and the uncertainty of the date of resumption of such production, the company has reduced the book value of patents, licenses, development and litigation expense to a nominal value of $1," Mr. Sayre said. "Tools, dies and machinery used in the manufacture of washing machines have been reduced to salvage value. The deductions from profits resulting from the above write-downs totaled $549,000 in 1941 and 1942."

•

New Movie Released by General Electric

A new sound movie, "2311," designed to spur the men and women in war plants to greater production, has been released by General Electric Co.; "2311" is being shown at local theaters in all cities where G. E. plants are located, and it is available without charge for showings by service clubs, industrial companies, fraternal groups and other organizations.

The name "2311" represents the number of American casualties incurred during the last 24 hours before the signing of the armistice at the close of World War I. The movie stresses the importance of a day or even an hour in producing the materials needed by our armed forces. It may be obtained upon request to the Visual Instruction Section, General Electric Co., Schenectady, N. Y., or to any of the company's district offices.

AVOID CABLE ABRASION *with*

STAPUT FAIRLEADERS

"Rubbing at the duct mouth can be reduced by installing fairleaders on the cables at this point." — from Electrical World, May 29, 1943 (Cables — How to Make Them Last).

These non-corrosive alloy cable shields clamp in place to take wear at duct mouth. Easily and safely installed without interruption of service. Eliminate expensive repairs. Use STAPUT FAIRLEADERS. *Write for free catalog.*

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Philco Pays Dividend

Philco Corp. has declared a dividend of 20 cents per share of common stock, paid on September 13 to stockholders of record August 28. Previous dividend payments this year were 15 cents per share on March 12 and 20 cents per share on June 12.

•

Will Redeem Debentures

Connecticut Light & Power Co. has called for redemption on September 21 at 104 all of its outstanding 3½ percent debentures, due September 1, 1956, C. L. Campbell, president, announced. The company has a large amount of cash and securities on hand, Mr. Campbell said, and anticipates little opportunity in the immediate future to use the money for the expansion for which it was intended, because of insufficient labor and material supply.

•

REA Allots $254,000 to Six Systems

The Rural Electrification Administration recently announced allotments totaling $254,000 to six systems, bringing REA allocations to date to $467,665,295, of which $719,000 represents operations during the current fiscal year.

The funds borrowed under these allotments will be used to finance facilities already completed in accordance with WPB regulations, to acquire existing properties which will facilitate electrification of additional farms in the post-war period, and for immediate extension of service to farms which qualify under existing WPB regulations permitting connections to nearby rural electric lines of farms producing livestock, dairy and poultry products. No new construction will be undertaken except in accordance with authorization or regulation of WPB and, in the case of the allotment involving acquisition of existing properties, funds allocated for new construction will not be used until after the war.

Details are as follows:

FLORIDA—Clay Electric Cooperative, Inc., Keystone Heights, $146,000 for 129.5 miles of line, 531 members; includes funds for purchase, rehabilitation and integration of 39.5 miles of line, 260 consumers.

IOWA—Nyman Electric Cooperative, Inc., Staton, $50,000.

MINNESOTA—Wells Electric Association, Wells, $10,000.

TEXAS—Victoria County Electric Cooperative Co., Victoria, $20,000. Stamford Electric Cooperative, Inc., Stamford, $10,000.

WASHINGTON—Stevens County Electric Cooperative, Inc., Colville, $18,000.

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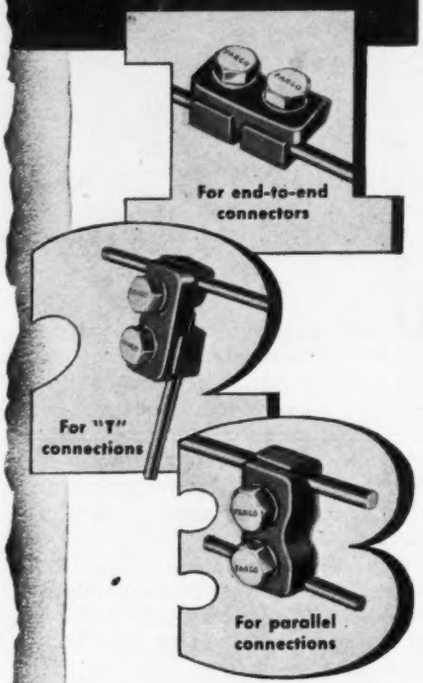

Any one of the three ways you use this Fargo "Du-All", you get a sure-gripping, high conductivity contact. To change it from one type of connector to another, simply loosen the clamping member and turn it to the desired position. High strength copper alloy bodies and Duronze bolts that last and last . . . available in a wide range of sizes especially adaptable for industrial and substation use.

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Light-reflecting floors made with Atlas White cement have many other advantages. They encourage cleanliness, are easy to maintain, reduce disturbing shadows, give workers better and more comfortable light, improve morale, increase production, and reduce accidents, errors and spoilage.

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EW-F-20

ATLAS WHITE CEMENT
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Sales Opportunities

TENNESSEE—Municipal Light, Gas & Water System, Memphis, has plans maturing for new power substation for feeder service for electric coaches of Memphis Street Railway Co. Cost reported over $80,000, with equipment. A priority rating has been secured and work will begin soon.

WASHINGTON—War Department, Washington, D. C., has approved plans for new military cantonment, comprising shops, warehouses and other industrial structures, with mechanical and electrical equipment. Also will install power substation and electrical distribution lines, with service connections and other operating facilities. Project will include barracks, mess halls and miscellaneous buildings, and is estimated to cost over $2,000,000. It will be supervised by U. S. District Engineer Office, Seattle. Work is scheduled to begin at once.

PENNSYLVANIA — Carnegie - Illinois Steel Corp., Carnegie Building, Pittsburgh, has contracted with government for expansion in certain mills in Pennsylvania, Indiana and Illinois, comprising new buildings and installation of machinery and electrical equipment. Entire program will cost about $1,500,000, with financing by Defense Plant Corp. Proposed to begin work at early date.

MARYLAND—Bureau of Water Supply, Baltimore, plans installation of electric-operated pumping machinery, with controls and other facilities in new pumping station for increased water source on Patapsco River, with rating of about 40,000,000 gals. per day. Entire project is estimated to cost approximately $5,000,000, and is scheduled to secure a priority rating. Leon Small is water engineer for Bureau.

CALIFORNIA—Imperial Irrigation District, El Centro, is perfecting plans for early acquisition of power plants and system of California Electric Power Co., in Imperial and Coachella Valleys, for a reported consideration of $4,900,000. Project will include expansion and improvements in properties, including new transmission lines for connection between existing and acquired high-tension systems, switching stations, power substations and other operating structures. Also extensions in distribution lines in different areas and service facilities. Fund of about $950,000 will be expended for this work. District has authorized surveys and plans for a new hydro-electric generating station and has appropriated $75,000 for initial engineering work on this development. A bond issue of $6,000,000 is being arranged for entire project.

NEW YORK—Chaplin Biological Laboratories, Inc., 401 West Taylor St., Syracuse, will carry out expansion in plant for production of "Penicillin," new bacteria-killing drug for military use, including new building, with machinery and electrical facilities for large output. Cost estimated about $850,000, with financing by Defense Plant Corp. Work will proceed at once.

ILLINOIS—War Department, Washington, D. C., has approved plans for new military cantonment, comprising shops, warehouses and other industrial buildings, with mechanical and electrical equipment. Also power substation, with electrical distributing lines, service connections and other operating facilities. Barracks and other housing structures will be erected. Entire project will cost approximately $1,000,000, and will be supervised by U. S. District Engineer Office, Chicago.

MICHIGAN—Ford Motor Co., Dearborn, has contracted with government for further expansion in a plant, including additional building, with machinery and electrical equipment. Cost estimated about $1,180,000, with financing by Defense Plant Corp. Work scheduled to be carried out soon.

NEW YORK—Navy Department, Washington, D. C., has authorized expansion in primary naval training base, including shops and other industrial buildings, with mechanical and electrical facilities. Power substation capacity will be increased and additional distribution lines built. Program also will include a new barracks to accommodate about 5,000 men, mess halls, ship service building and miscellaneous structures. Cost estimated about $2,500,000. It is proposed to award contracts in October and to complete work next spring. Bureau of Yards and Docks, Navy Department, Washington, will be in charge.

NEBRASKA—War Department, Washington, D. C., has authorized expansion in aircraft assembling plant, including several new one-story buildings, with machinery and electrical equipment. Cost estimated close to $1,000,000. Project will proceed at early date under supervision of U. S. District Engineer Office, 1709 Jackson St., Omaha.

WASHINGTON — Boeing Aircraft Co., Seattle, has contracted with government for expansion in plant for production of military airplanes, including additional building with machinery and electrical equipment. Cost estimated about $650,000, with financing by Defense Plant Corp.

INDIANA—Indianapolis Power & Light Co., Indianapolis, is reported arranging post-war project for expansion and improvements in power plant on White River, including installation of equipment for increased capacity. Also for extensions in transmission lines and additional power substation facilities. Cost estimated about $2,000,000.

OHIO—Industrial Rayon Corp., East 98th St. and Walford Ave., Cleveland, manufacturer of cellulose rayon products, will begin work at once for expansion in branch mill, to include several new processing and production buildings, with machinery and electrical facilities for large capacity. Mill output will be increased over 100 percent. Entire project is reported to cost over $4,000,000, and will be financed by company.

LOUISIANA—Department of Aviation, New Orleans, Douglas O. Langstaff, director, plans expansion in municipal airport, including hangars, shops and other industrial structures, with mechanical and electrical equipment. Also new overhead and underground distribution lines, control station, lighting and other electrical facilities. Project will include an administration building and other general structures, and is reported to cost in excess of $2,500,000. A bond issue of $5,000,000 is being considered for this and other aviation development, including maintenance.

INDIANA — Schenley Distillers Corp., Lawrenceburg, has approved plans for addition to power plant at local distillery, about 47 x 55 ft., estimated to cost close to $225,000, with equipment.

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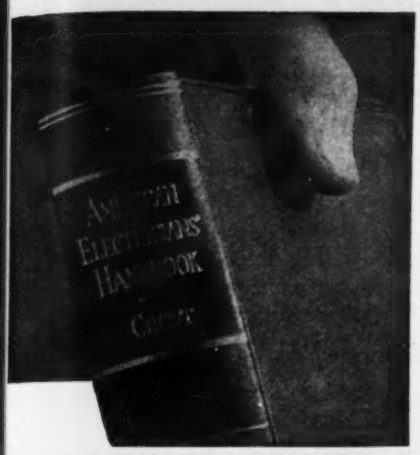

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LETTER TO THE EDITOR

Kalamazoo's Height Above Sea Level

To the Editor of ELECTRICAL WORLD:

Just on the chance that some one raises the questions relative thereto, it is noted that in redrawing the connection diagram associated with the article "Resistors Watch Level in Water System Reservoir," ELECTRICAL WORLD, August 21, 1943, page 61, two errors have been made:

The water elevations shown are *not* above sea level. These are arbitrary elevations referred to an arbitrary datum. To convert these to "above sea level," 685.76 should be added to each of them. (This probably would make no difference to any one except some one knowing the locality and knowing that Kalamazoo is considerably over 200 feet above sea level.)

The output voltage of the voltage-regulating rectifier is 105 volts at the terminals of the rectifier. Your draftsman has shown this voltage after it has passed through relay No. 1.

EARL NORMAN,
General Superintendent,
City Light and Water Utilities,
Kalamazoo, Mich.

■

San Antonio Award Made

The City Public Service Board of the city of San Antonio, Tex., has awarded to Gibbs & Hill of New York a contract for the engineering and supervisory construction of a $2,000,000 addition to the city's secondary electric power plant. WPB has released material for the construction.

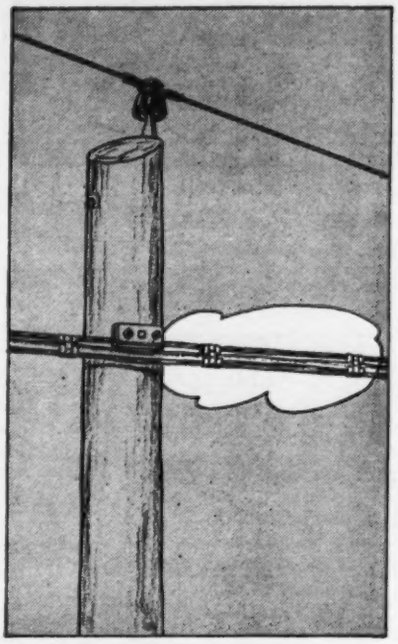
Utility Coal Consumption

Electric utility power plants consumed 6,780,062 tons of coal in July, the Federal Power Commission has reported. Coal stocks of electric utility power plants as of August 1, according to the report, were 8.4 percent over the same date last year.

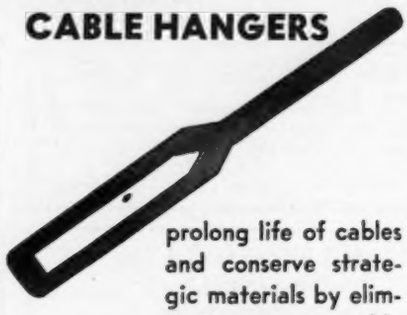
Vote Conservation Fund

The National Association of Power Engineers voted at its sixtieth annual conference, held recently in Buffalo, N. Y., to create a $25,000 fund to promote education in conservation of fuel, materials and personnel and to establish a study course in electrical engineering.

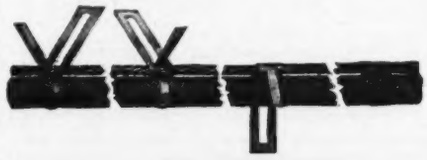
Reduce Outages Avoid Cable Wear Reduce Maintenance



RELIABLE CABLE HANGERS



prolong life of cables and conserve strategic materials by eliminating wear on cable sheaths or on insulation of hand made cables. Reliable cable hangers hold cable and messenger together tightly with wide bearing surfaces which eliminate snaking and chafing. They are easily applied and make installations that are permanent and very neat.



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Post-War Lighting Meetings Planned

Anticipating rapid post-war expansion in the field of home lighting, the New York Residence Lighting Forum is planning a series of educational meetings for the coming year, beginning in October. Home-lighting specialists are devoting most of their time at present to problems of eyesight conservation under conditions of blackout, dimout and electricity conservation. The forum meetings will give members an opportunity to obtain information on new lighting developments and their application in the home, and thereby prepare themselves to render a service to the public which will be as valuable after the war as it has always been. Although wartime restrictions prohibit expansion of residence lighting facilities for the duration it is vital that specialists in this field keep abreast of the many recent advances in the field of illumination.

The New York Residence Lighting Forum is affiliated with the Illuminating Engineering Society, New York Section, whose forum representative is Henry L. Logan. Miss Myrtle Fahsbender represents the I.E.S. National Subcommittee on Residence Lighting Forums. Elizabeth L. Woolley will be forum chairman and Priscilla Presbrey secretary-treasurer for the coming year.

•

Frankfort, Ky., Takes Over Utility

Municipal operation of the Frankfort, Ky., electric and water systems began recently—a year and a day after the city first offered to buy the properties. The city assumed control on completing details of the transaction in which it purchased the properties for $1,200,000 from the Tri-City Utilities Co., subsidiary of Associated Electric Co.

An electric rate cut, estimated at about 15 percent, was announced by the board named by the City Council to operate the sytems, effective on current consumed in September and billed in October.

Roger Adams, board treasurer, said steps would be taken immediately to refund an estimated $54,000 in impounded funds to electricity consumers. The money was impounded under court order after Tri-City contested a rate cut ordered last December by the Public Service Commission.

Harold K. Hines, former manager and president of Tri-City, was named by the board to manage municipal operations at a salary of $6,000 a year.

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POSITIONS VACANT

ENGINEER on Electrical Distribution both REA and Steel. State previous experience, education. Must have contractor's viewpoint and actual experience in estimating and supervising. Excellent opportunity for high type individual. P-600, Electrical World, 330 W. 42nd St., New York 18, N. Y.

YOUNG ELECTRICAL ENGINEER for work as assistant to office engineer in large mining organization, Chile, South America. 3 year contract, transportation both ways and salary while traveling paid by company. In reply give complete details. P-601, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ACCOUNTANT OR ENGINEER-ACCOUNTANT with initiative and resourcefulness—must be experienced in and have thorough knowledge and creative record in the field of public Utility construction, plant and operations accounting. Headquarters and some work in New York with extensive travel required. Furnish full particulars of qualifications and experience. P-605, Electrical World, 330 W. 42nd St., New York 18, N. Y.

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POSITIONS WANTED

ELECTRICAL CONSTRUCTION ENGINEER, age 52, 30 years experience installation, test and repair, also line construction. Married, good health, and permanent position only considered. Northwest preferred. PW-577, Electrical World, 68 Post St., San Francisco 4, Cal.

OPERATING EXECUTIVE — Age 40, broad utility experience. Successful record achieving practical results by maintaining coordinated organization and harmonious employee relations. Engineering background with well rounded experience in generation, transmission, distribution, sales, rates, accounting, administration, public relations. Interested in general supervisory position as superintendent, manager or executive assistant. Prefer position offering opportunities for improved operations. PW-586, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

MANAGER—Wide experience electric, gas, and other utilities. Steam, hydro, diesel drive. Familiar all departments. Can successfully handle difficult situations. Past draft age. At liberty to consider a change. Highest references. PW-594, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

(Continued on page 157)

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9—2500 H.P. **General Electric Induction Motors.** Motor Numbers: 5283038, 5283041, 5283042, 5283043, 5283044, 5283046, 5283047, 5283048, 5283049, 5283050. Type MT-28-2500-257, Form AE, 60-cycle, 3-phase, 6600 Volts, 202-amp., secondary volts 706, secondary amps. 1530, speed full load 253 R.P.M., continuous rise 40 degree centigrade. With Starting Equipment.

1—1500 H.P. **General Electric Induction Motor,** No. 5393731, Type MT-28-2500-257, Form AE, 60-cycle, 3 phase, 6600 Volts. Complete with Starting Equipment.

PUMPS—Hydraulic

7—**Hydraulic, Centrifugal,** 33" intake and 28" discharge, complete with impeller, front and back doors; with Thrust Bearing and Shafts.

4—**Pumps, National Transit,** No. 49075, HORIZONTAL DUPLEX PISTON PUMP, capacity 120 G.M.P. at 415 foot head, size 4½" x 10", with motors and accessories.

2—**Pumps, Vertical Centrifugal, Yeoman Bros.,** 4" x 4" 50" overall height of pump, single-stage, 400 G.P.M. at 250 foot head. Accessories.

2—**Pumps, National Transit, No. 49073, Horizontal Duplex Piston Pump,** size 5⅛" x 10", capacity 180 G.P.M. at 180 foot head with motors & Accessories.

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15—**25-KVA Transformers, Distribution, G. E.,** Type H, Form KB, Addative polarity, single-phase, 60 cycle, 5940/6600/11430Y to 230 volts, continuous 55 degree centigrade rise, diagram No. 3978194, approximately 3.6% impedance at 6600 volts and 75 degrees centigrade, capacity 31 gallons of 10-C transil oil. Instructions GEJ-56.

6—**15-KVA Transformers, Distribution, G. E.,** Type H, Form KB, Addative polarity, single-phase, 60 cycle, 59/6600/11430Y, to 115 Volts, Cap. 16 Gal., 10-C transil oil.

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1—1000	Whse.	900	600	2300
2— 750	Whse.	1200	600	2300/4000
1— 300	G.E.	1200	600	13200

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1—750 KW, 250 volts, Allis-Chalmers, synchronous
1—75 KW, 125 volts, Crocker-Wheeler, synchronous
1—35 KW, 125 volts, Electric Machinery, squirrel cage

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1—400 HP, 514 RPM, 440 volt, Westg. slip ring
1—335 HP, 600 RPM, 2300 volt, GE, syn.
1—300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—250 HP, 600 RPM, 2200 volts, G.E., slip ring
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, General Electric, squirrel cage.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
1—125 HP, 720 RPM, 440 volt, G.E., slip ring
1—100 HP, 900 RPM, 440 Westinghouse, sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., slip ring.
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1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whir. sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E. sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1—75 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—50 HP, 900 RPM, 440 volt, G.E., slip ring.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, 400 RPM, G.E.
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
2—150 HP, 400/550 RPM, Westinghouse, type SK.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—65 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 775 RPM, Westinghouse.

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2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, G.E., 6600/2200 volts, 220/440 volts.
1—200 KVA, Pittsburgh, 7800-110/220 volts.
3—200 KVA, General Electric, 2200-220/440 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, General Electric, 2200-220/110 volts.
3—75 KVA, G.E., 13,500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 v.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

1—150 HP, 350/1050 RPM, Crocker Wheeler.
2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—85 HP, 500/1500 RPM, Westinghouse.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
2—11½ HP, 500/1500 RPM, Westinghouse, type SK.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

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25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

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600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt cond.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
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Well-established company manufacturing terminal boxes, control and switchboard panels, meter housing boxes and other electrical products, well-located in large Southern city, offered for sale as going concern. Modern plant with complete and up-to-date machinery. Address

BO-598 Electrical World
330 West 42nd St., N. Y. C. 18, N. Y.

for **INFORMATION**

on products or services not contained in this—or any—issue of Electrical World, please write:

Departmental Staff, ELECTRICAL WORLD, New York City

POSITIONS WANTED

(Continued from page 155)

SAFETY DIRECTOR—Electric utility, long experience management and safety work, large organization. Assume full charge safety activities. Unimpeachable record. Confidential negotiations. Min. salary $4,800. PW-595, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER OR MANAGER: Experience in electric and gas utilities in engineering, construction, operation and management. Good industrial, manufacturing experience in power applications and lighting. Have reduced operating expenses by savings introduced. Electrical engineering theory backed up by good practical experience. Protestant, physically fit, age 47, head of family. Make connection permanent if mutually adventageous. PW-602, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER. Registered. Experienced in supervision of Design, Construction and Operations. Father. Draft age. Desire connections with essential industry within United States. PW-603, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL REPAIRMAN desires position with Public Utility Company. Technical trained, capable motor and armature winder, also meter work. 30 years experience. PW-604, Electrical World, 330 W. 42nd St., New Work 18, N. Y.

SELLING OPPORTUNITIES
OFFERED—WANTED
Selling Agencies—Sales Executives
Salesmen—Additional Lines

WANTED

MANUFACTURERS' AGENT with Transformer Line in Chicago District with warehouse facilities, desires lines to go with same; such as Switches, Fuses, Solderless Connectors and the like. Can guarantee over 100 active accounts. RA-587, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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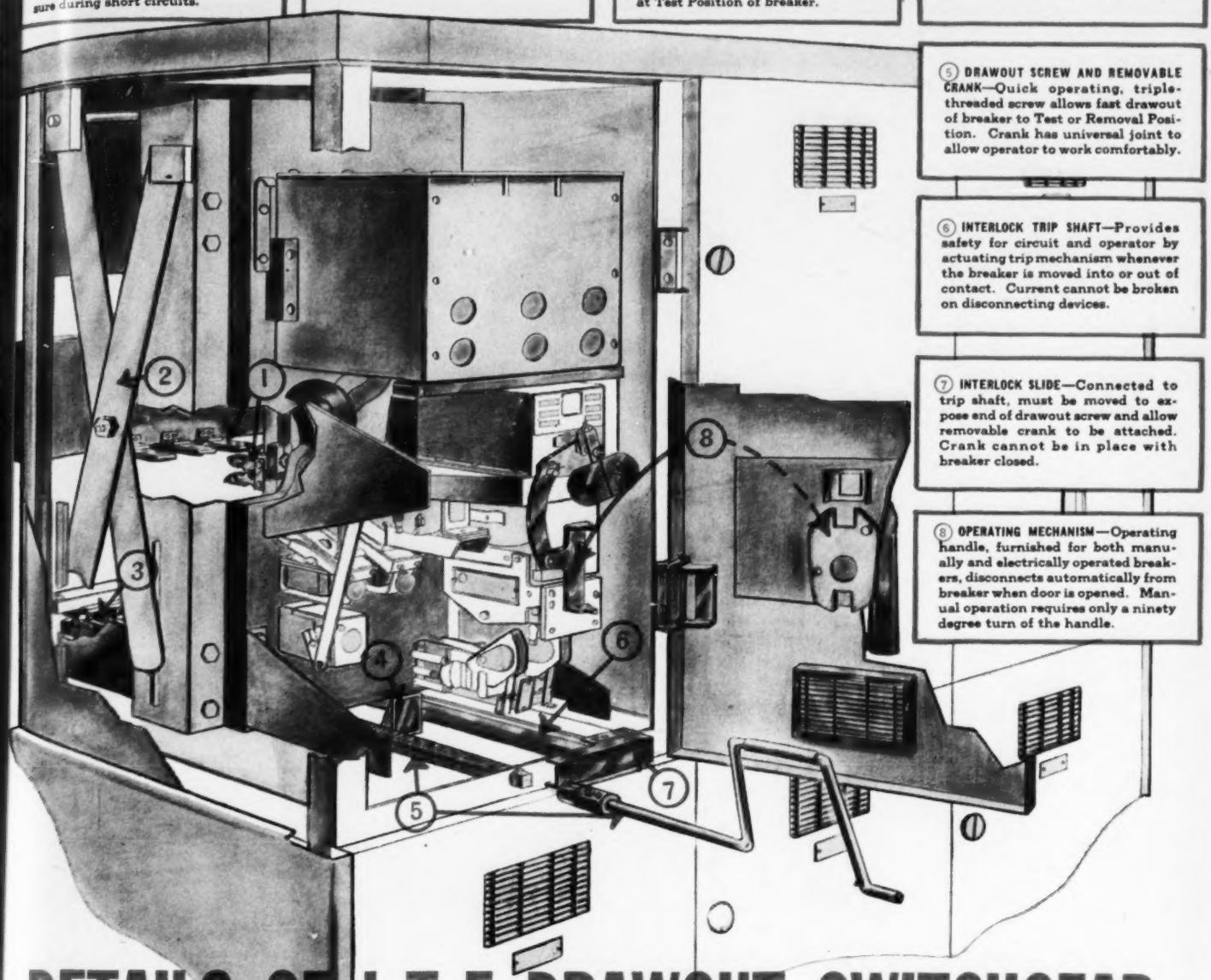


1 PRIMARY DISCONNECTING DEVICES—Self-aligning fingers on removable element allow safe inspection away from live parts. Silver plated for freedom from overheating. Divided current path increases contact pressure during short circuits.

2 PANTOGRAPH MECHANISM—A strong support for the circuit breaker, eliminates need for extension rails and saves time in removing breaker for servicing.

3 SECONDARY DISCONNECTING DEVICES—For control relay, auxiliary switch and other small wiring circuits. Self-adjusting, silver plated. Flexible members mounted on removable element. Contacts closed at Test Position of breaker.

4 POSITION INDICATORS—Breaker panel lines up with indicators when breaker is Closed, connected or in Test Position. Protect breaker against being closed with disconnecting devices only in partial contact.

5 DRAWOUT SCREW AND REMOVABLE CRANK—Quick operating, triple-threaded screw allows fast drawout of breaker to Test or Removal Position. Crank has universal joint to allow operator to work comfortably.

6 INTERLOCK TRIP SHAFT—Provides safety for circuit and operator by actuating trip mechanism whenever the breaker is moved into or out of contact. Current cannot be broken on disconnecting devices.

7 INTERLOCK SLIDE—Connected to trip shaft, must be moved to expose end of drawout screw and allow removable crank to be attached. Crank cannot be in place with breaker closed.

8 OPERATING MECHANISM—Operating handle, furnished for both manually and electrically operated breakers, disconnects automatically from breaker when door is opened. Manual operation requires only a ninety degree turn of the handle.

DETAILS OF I-T-E DRAWOUT SWITCHGEAR ARE WELL WORTH YOUR STUDY

To know the details of Multumite drawout switchgear is to have in mind a measure for determining what you will one day want to specify--a useful guide when the time comes for new installation of completely metal-enclosed switchgear structures.

The advantages noted above are but a few of many. For a thorough description, have us send you Bulletin 4207 which plainly identifies and illustrates the features incorporated by I-T-E for safety and convenience in control and distribution of electric power.

I-T-E

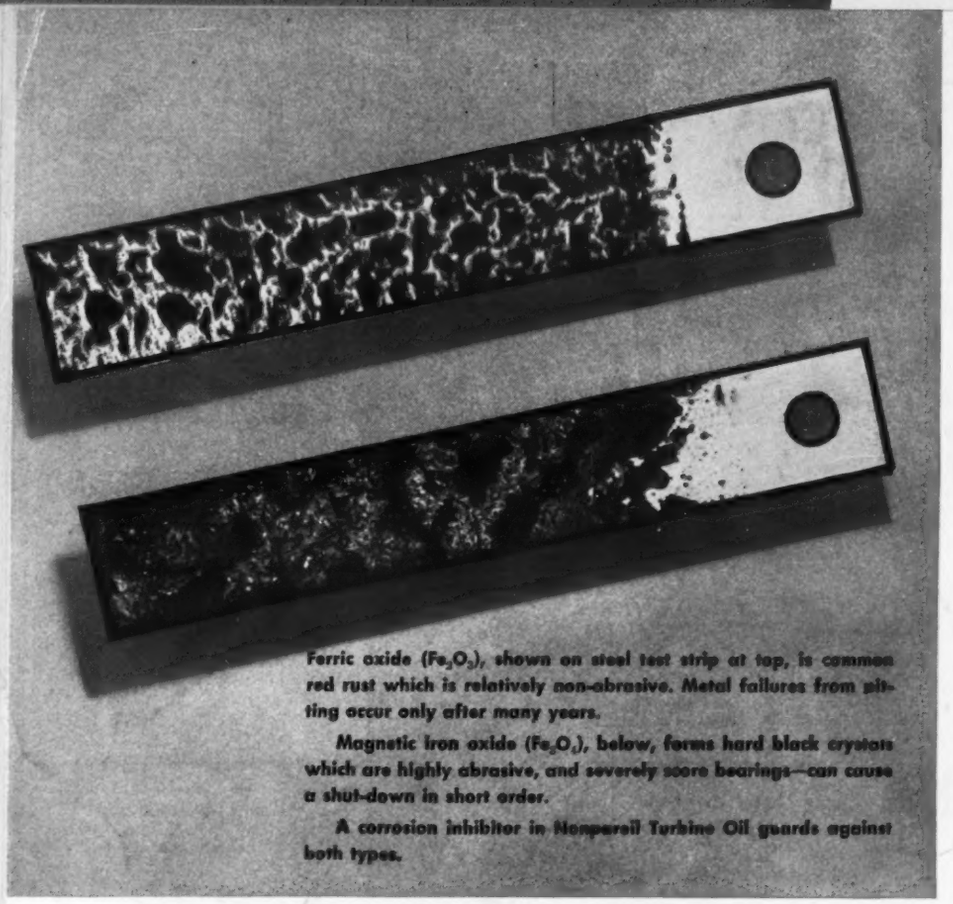
AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

I-T-E

Representatives in Principal Cities

CIRCUIT BREAKER CO., PHILADELPHIA, PA.



Ferric oxide (Fe_2O_3), shown on steel test strip at top, is common red rust which is relatively non-abrasive. Metal failures from pitting occur only after many years.

Magnetic iron oxide (Fe_3O_4), below, forms hard black crystals which are highly abrasive, and severely score bearings—can cause a shut-down in short order.

A corrosion inhibitor in Nonpareil Turbine Oil guards against both types.

Turbine Corrosion

Its occurrence, cause, and correction

AS TURBINE EFFICIENCY was improved by higher speeds, temperatures, and steam pressures, oils that had been satisfactory for older turbine designs began to form sludge and other deposits. To eliminate these deposits more highly refined oils were introduced. But the higher degree of refining which removed deposit-forming elements also removed corrosion inhibitors from the oil, and resulted in a new and serious type of corrosion.

Two types of corrosion. Common rust (Fe_2O_3) is the most familiar type. It occurs on iron parts such as storage tanks, reservoirs, and oil lines where there is moisture above the oil level, or where water accumulates in pockets and depressions. This type does little damage unless allowed to continue over a period of years. Parts subject to such damage are sometimes treated with special protective coatings.

The most serious type of corrosion which has developed in recent years is caused by water carried in suspension in the oil. Even a small percentage of moisture—as low as 0.1%—will cause this corrosion. It forms dense, hard crystals of magnetic iron oxide (Fe_3O_4) which is highly abrasive and severely scores bearings—can clog oil lines and governor mechanisms in short order.

Corrosion problem analyzed. Nonpareil Turbine Oil has contained a corrosion inhibitor since 1926. But corrosion prevention has been under continuous study in our laboratories. Hundreds of tests have been made to find improved additives which would give increased protection against corrosion. Many products were excellent as rust preventives, but because of high acidity, poor demulsibility, poor color, etc., could not be incorporated without impairing the other desirable qualities of Nonpareil. From these tests emerged one thoroughly satisfactory rust preventive.

Passes A.S.T.M. test with perfect strip. Recently the American Society for Testing Materials developed Test D665-42T for determining the ability of Turbine Oil to aid in preventing the rusting of ferrous parts in the presence of water. Nonpareil Turbine Oil passes this test with a perfect test strip, and gives long time protection.

Get all the facts. You'll want to learn more about this interesting development. Send for a Standard Lubrication Engineer. He'll be glad to supply full test data and service records. Call any Standard Oil Company (Indiana) office, or write 910 S. Michigan Ave., Chicago 5, Illinois. In Nebraska, address Standard Oil Company of Nebraska at Omaha 2.

Oil is ammunition . . . Use it wisely

★ ★

NONPAREIL TURBINE OIL

★ ★

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING